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Young People's Perspectives of Public Engagement with Science:

a collaborative, intergenerational case study

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Declaration

This thesis has been written by me and is submitted for the award of PhD at the University of Edinburgh. The work is my own, except where it is stated otherwise by reference. No part of this thesis has been submitted elsewhere for any other qualification.

Stuart Dunbar

THE UNIVERSITY of EDINBURGH

Lay Summary of Thesis

The lay summary is a brief summary intended to facilitate knowledge transfer and enhance accessibility, therefore the language used should be non-technical and suitable for a general audience. Guidance on the lay summary in a thesis. (See the Degree Regulations and Programmes of Study, General Postgraduate Degree Programme Regulations. These regulations are available via: www.drps.ed.ac.uk.)

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This thesis focuses on Public Engagement with Science. This is an area of work where public groups are connected with science in a variety of ways: from sharing the latest scientific research through to the involvement of non-scientists in the development of scientific knowledge (e.g. collaborating on setting the direction of research, contributing to collecting data, analysing data and drawing conclusions).

How young people engage with science outside of formal learning situations is an emerging area of focus, yet there remains a particular absence in understanding how young people can be involved in generating scientific knowledge.

To help address this lack of attention, 13 senior pupils (16-18 year olds) from local secondary schools collaborated with an adult researcher as part of Young SAGE (Science Advisory Group for Engagement). Together, they explored how hands-on science

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activities affected children's engagement with science through a combination of surveys and an interactive event.

Based on this collaboration, this thesis analyses the progression of the Young SAGE project, particularly looking at:

1. the challenges for the adult researcher in working collaboratively with young people;
2. how young people developed ownership of the project as it progressed;
3. the aspects of science experiences that are important for young people; and
4. how young people are attracted to more involved forms of public engagement with science (i.e. contributing to the development of scientific knowledge).

The improved knowledge presented within this thesis will benefit those who engage young people with science (e.g. parents and teachers, professional groups visiting schools or welcoming young people into their spaces, individuals who create online science engagement experiences, etc.). For those seeking collaboration with young people within scientific activities, there is specific learning about the potential obstacles that need to be considered and overcome, particularly through paying greater attention to the notion of project ownership. Furthermore, by focusing on project ownership ideas and fostering this within participants, this thesis contributes to ideas of participation and collaboration within Public Engagement with Science. By extension, this thesis also challenges claims on how young people can lead research projects within formal, adult-instigated projects.

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Acknowledgements

> "If you can't fly, run. If you can't run, walk. If you can't walk, crawl, but by all means, keep moving."
>
> Martin Luther King Jr, 1967

Without a set of incredible people around me, the above principle would have been impossible to adhere to and this thesis would never have been produced. Therefore, I would like to recognise those who have supported my struggle (whether they realised it or not) at various points along my journey.

Firstly, the Young SAGE participants. A simply brilliant set of people who shared my interest in exploring ways to engage young people with science, and were crucial to my research. Without your knowledge, enthusiasm, openness, commitment, humour, and time, I would have got absolutely nowhere and achieved precisely nothing. Our collaborative approach was a risky (but necessary) choice, and one that led to such a wonderful experience. I sincerely hope you all feel that you personally benefitted from your involvements in some way. I know that I definitely have. It's been great to keep in touch with many of you after the project too, and I don't think I'll ever forget how thrilling a low-scoring bowling game can actually be!

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To my friends – whom I won't name individually for fear of accidently missing someone out and not hearing the end of it for the rest of my life – I am eternally grateful for not only your patience but also your interest in my research (sometimes serious, sometimes more jovial). In trying to balance life's priorities, I apologise for being less available and quieter over the past few years, and I will try to return to the social spheres I occupied more frequently in the medium-term past!

To Miia, Jack, Helena, and Hanna: thank you for checking on my progress, the insightful questions, and the joyous and relaxing times in Tartu and elsewhere. You've kept me on my toes and provided positive distractions in equal measure over the course of my research. I'd also like to express my gratitude for welcoming me so warmly (and hiding so well) your begrudging acceptance of Kristiina's life-choices! (This is a joke…) Things have changed so much since the summer of 2011! Thank you Jack for your forensic proof-reading (and any remaining errors are mine and mine alone).

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Finally, to Kristiina, my girlfriend / 'partner' (ugh!) / fiancée at various points during the progression of my research project, and now my wife. You have lived every high and low of this PhD process and your unfaltering presence throughout each and every step has been so important in getting to this final stage. Thank you for giving me the space when I've needed it, distracting me when necessary, loving me unconditionally, and motivating me to complete this epic journey that I set for myself. You have helped me to keep going, even when there was no end in sight. I can never truly repay you, but I promise that I will certainly try my best.

Abstract

As a field, public engagement with science has evolved from a communicative foundation (i.e. public understanding of science) to now embrace consultative and participative modes where non-scientists have greater involvement in the development of scientific knowledge. However, scant attention has been given to the potential roles and understandings of young people within this more diverse collection of modes that comprise public engagement with science. Fortunately, the interdisciplinary field of childhood studies provides tools to fill the void with its explicit focus on notions of children and young people.

Therefore, this thesis combines public engagement with science and childhood studies through my Young SAGE project – an intergenerational collaboration – thereby addressing this academic oversight. Based on a reflexive thematic analysis approach, I initially illustrate the challenges for the adult researcher in attending to generational power dynamics that result from formal research requirements (including ethics guidance) and normative societal expectations.

Then, paying careful attention to the intergenerational power dynamics within the Young SAGE collaboration, I highlight how participants developed ownership of different project facets by deciding on the substantive project and exhibiting distinct levels of decision-making leadership in progressing the overall project. Despite positive progress within the Young SAGE group, I also reflect on specific tensions caused by normative age-segregated perspectives when participants engaged other adults beyond the confines of our intra-group interactions.

Finally, I incorporate the above analysis within an exploration of perspectives and insights into public engagement with science involving young people. Young SAGE participants expressed personal narratives that positioned themselves as agents capable of seeking communicative experiences to spark, or build on, existing interests, as well as to inspire ideas for future careers. Furthermore, their very

involvement in Young SAGE, illustrates the potential for young people to contribute to the development of scientific knowledge. However, due to the generational structure of society – at least in the Minority World – it is necessary to consider how to maximise the appeal of engagement exercises to ensure they are attractive to young people and motivate their involvement, especially in collaborative contexts.

In sum, this thesis delivers valuable insights, highlighting young people's agential capacities, and articulating the potential barriers and affective dimensions that should be attended to within public engagement with science as it pertains to young people. In so doing, this thesis also reveals how the power dynamics implicit within the generational order of society marginalise the potential for young people's contributions in the practice of science.

1 Introduction: exploring public engagement with science through an intergenerational approach

I have been intrigued by science for most of my life. As a child, I was fascinated with how things worked. I interrogated the world around me and constantly asked questions to find out more – sometimes to the immense frustration of my teachers![1] The allure of science remains to this day, being reflected by my choice of physics for my undergraduate studies, my enthusiasm for teaching science when I was a primary-school teacher, and my long-standing university-based role engaging children and young people with science.

However, several years ago, I started to question my practice. Although feedback from those engaged through the events I coordinated appeared good – very good – I could not ignore my doubts. As a broad summary of these stubborn thoughts: How do young people want to engage with science and are they able to access or develop opportunities that suitably appeal?

This extended question has provided the driving motivation throughout the study upon which this thesis is based, and serves to bring together two key fields of knowledge for the first time: public engagement with science and childhood studies.

Public engagement with science has evolved from a purely communicative foundation (i.e. public understanding of science) to now actively embrace consultative and participative modes in which non-scientists are more involved in developing scientific knowledge. Unfortunately, scant attention has been given to the roles of young people, and their potential for contribution, across the diverse modes that comprise public engagement with science approaches. Fortuitously, the interdisciplinary field of childhood studies, with its explicit focus on children and

[1] My mum was more patient, for which I am eternally grateful.

young people, offers theoretical and methodological tools that enable this lack of attention to be addressed.

As a result, this thesis pushes the boundaries by exploring young people's perspectives of public engagement with science through a collaborative study. I particularly focus on notions around participation: the involvement of individuals in a process where their contributions actively influence the goals and consequent impacts of that process (see Rowe and Frewer 2005, Cairns 2006, Tisdall *et al.* 2008). My focus is directed to participation as a general engagement concept, as well as by reflexively considering the development and implementation of the research project itself. As a result, in chapter 3, I offer in-depth methodological considerations as contributions to knowledge that are in addition to my main thesis focus.

In recent years, there has been academic encouragement for greater involvement of non-scientists within the development and utilisation of scientific knowledge (e.g. Wynne 1992a, Bucchi and Neresini 2007, Jasanoff 2014), as well as the governance of science and the direction of scientific research (e.g. Irwin 2001, Wynne 2001, Lock 2011, Stirling 2012, Pallett and Chilvers 2013, Sturgis 2014). This encouragement has been reflected by calls from policymakers (House of Lords Select Committee on Science and Technology 2000, European Commission 2017) and shifts in engagement practice (The National Co-ordinating Centre for Public Engagement 2018). In combination, these developments have been founded on arguments that science overlaps and interlinks with wider society and is not a separate endeavour (Wynne 1992a, Jasanoff 2004, Bucchi and Neresini 2007, Sturgis 2014). Almost concurrently, there has been a parallel shift in childhood studies, which has argued for children and young people to have greater involvement within research through being active contributors rather than solely being a provider of information (Prout and James 1997, Alderson 2001, Hill *et al.* 2004, Kellett *et al.* 2004). These movements suggest, for both non-scientists in public engagement with science, and children and young people in childhood

studies, there is rightfully a need to recognise their respective abilities to contribute rather than their earlier, solely passive, depictions.

However, it seems little consideration – both academically and in practice – has been given to the actual involvement of children and young people within public engagement with science processes. Occasional focus has, for example, been given to the views of younger science festival attendees through survey-based methods (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015). Nevertheless, there is a significant gap in the literature around seeking perspectives across a breadth of different science experiences (e.g. public lectures, online citizen science games, and independent small-scale research projects) and exploring an individual's sum experiences of – and current involvement with – science. Given the existing encouragement towards more participative (and perhaps collaborative) approaches (Bucchi and Neresini 2007, Jasanoff 2014, European Commission 2017), in combination for greater insights into public perspectives on engagement processes (Stilgoe *et al.* 2014), I contend it is crucial to improve understandings of how young people perceive opportunities to participate within science experiences and how these opportunities can be enabled.

My research focus also responds to appeals from prominent childhood studies academics for learning about childhoods to be used in influencing social and political debates within arenas away from childhood studies (Alanen 2009, Punch 2019, Thomas 2019). Although some articles in mainstream journals are already founded on childhood notions or focus on children – such as Calarco (2011), Strhan and Shillitoe (2019), and Mullan (2019) – there remains a need to add to these and move childhood studies away from its present inward-looking territory (Thomas 2019). Additionally, in both childhood studies and public engagement with science, the notion of project ownership (Wiley 2009, Hanauer *et al.* 2012) and how this affects participation has also been overlooked. Consequently, my thesis contributes significantly towards addressing the above gaps through a case study approach that shines a light on the opportunities and obstacles around intergenerational

collaborations between adults and young people, in addition to offering greater insights into the science-engagement preferences of young people.

1.1 Study context: the evolution of public engagement with science

Within the UK and elsewhere in the Minority World[2], there has been a long-standing policymaker chorus for the importance of science and science-related careers for current and future prosperity – a frequent foundation for research into young people's science-related careers aspirations (e.g. Bennett and Hogarth 2009, Aschbacher *et al.* 2010, Archer *et al.* 2013). This chorus converges around the idea of STEM: Science, Technology, Engineering, and Mathematics (Department for Education 2017, Scottish Government 2017).[3] Where children and young people are concerned, the focus is solely on preparing them with the STEM skills required to enable them to contribute to the economic future of the nation (Department for Education 2017) and to address estimated shortfalls in those leaving education with the skills required to enter this STEM workforce (Scottish Government 2017). Within these policymaker agendas, no consideration is entertained around children and young people's current capacities to contribute to the development of scientific knowledge: the focus is solely on the future.

With respect to public engagement[4] more specifically, a crucial area of policymaker focus has been on the formal role of non-scientists within the development of scientific knowledge (House of Lords Select Committee on Science and Technology

[2] The terms 'Minority World' and 'Majority World' are employed as more respectful equivalent terms for 'Developed Nations' (mainly Europe / North America) and 'Developing Nations' (mainly Africa / Asia) (Alanen 2014). Although simplistic, the use of Minority/Majority reflects the relative sizes of the respective populations, land-masses, etc. and attempts to bring attention to the usual focus on 'western' perspectives in the literature (Punch and Tisdall 2012). The term was first coined by notable photographer Shahidul Alam (2007) and has since gained traction in childhood studies circles.

[3] Sometimes STEMM is employed to explicitly include medicine as a separate, but related thread. STEAM is another related acronym: this has a different nuance where 'creative' arts are included as a vehicle through which STEM concepts are explored or presented.

[4] At times, 'public engagement' will be used from this point as a shorthand for 'public engagement with science'.

2000, Irwin 2001). In the 1980s, there was no such role (Gouyon 2016). Instead, there was concern around the perceived lack of public support for science as an enterprise, which was linked to the idea of a general public that knew very little science according to the Royal Society's Bodmer report in 1985 (Gouyon 2016). This conclusion motivated a 'public understanding of science' crusade to address the perceived problem of a detached general public: get them to better understand science and they will support the pursuit of improving scientific knowledge, which would consequently make it politically easier to fund scientific research[5] (Wynne 1992b). This funding motivation has perhaps not completely disappeared (Weingart and Joubert 2019).

However, during the 1990s, there was a reaction against the notion that more (public) knowledge would unquestionably result in greater support for science (Short 2013). This so-called deficit model has been criticised for disregarding how people make contextualised judgements about all types of knowledge, including scientific, within their decision-making (Lock 2011). Moreover, the depiction of a homogeneous general public, which is disinterested in science ahead of being told about scientific developments, has been condemned (Wynne 1992b, Bucchi and Neresini 2007). Research has also revealed that there was no widespread negative perception of science nor a distrust of scientists (INRA (Europe) and Report International 1993, Ipsos MORI 2018)[6]. Instead, there seems to have been local tensions within specific engagement examples (Wynne 1992a, Wynne 2001, Haddow and Cunningham-Burley 2008) rather than a society-wide distrust. There was also a reaction against what was being problematised: in the public understanding model all the issues related solely to the public, nothing was questioned about science itself or the role of science within wider societal contexts (Wynne 1992b, Wynne 1995, Bucchi and Neresini 2007).

[5] A particular issue at the time since the UK Government had reduced funding of scientific research, encouraging industry to fill the gap (Lock 2011).
[6] The term 'scientist' has only been used in this survey of public trust since 1997, when trust in 'scientists' was rated at 63% and has risen since.

Confronting the deficit model provided the launchpad for public engagement with science (Short 2013). Rather than conceiving the public as disinterested, this evolution offers a more nuanced set of modes where the perspectives of non-scientists may actively contribute to the development of scientific knowledge (Rowe and Frewer 2005). This conceptualisation resulted in major programmes of activity in the UK to gain wider insights on how scientific developments that were regarded important by policymakers should, or should not, be embraced (Irwin 2001). One of the most high-profile of these engagement programmes was the UK's Public Consultation on Developments in the Biosciences (PCDB), which sought to incorporate perspectives from non-scientists around bioscience topics, such as genetically modified foods and genetic cloning (Irwin 2001). This consultative approach was a response to society-level concerns regarding genetically modified foods, arguably heightened by the BSE crisis earlier in the 1990s that contributed to policymaker perception of a weakening of confidence in scientific advice around new innovations (House of Lords Select Committee on Science and Technology 2000). However, the power dynamics at the heart of the PCDB exercise (and similar ventures) arguably limited the extent to which public participants were permitted to contribute (Irwin 2001) with the timing too late for the exercise to play a genuine role in influencing research priorities (Lock 2011).

Over time, the practice of public engagement with science has further evolved in response to academic and political developments. In the early part of the 21st century, UK government funding established the National Co-ordinating Centre for Public Engagement (NCCPE), as well as six Beacons: university-based collaborations that would each enhance public engagement practice within their local settings (The National Co-ordinating Centre for Public Engagement, no date). Similar follow-up projects sought to build on initial learning through additional UK universities (Duncan and Manners 2016). Although not solely focused on science, the NCCPE developed and refined a definition for public engagement that is relevant to all research:

> Public engagement describes the myriad of ways in which the activity and benefits of higher education and research can be shared with the public. Engagement is by definition a two-way process, involving interaction and listening, with the goal of generating mutual benefit. (The National Co-ordinating Centre for Public Engagement 2018)

Instead of non-researchers being passive and disinterested entities, the definition of public engagement here opens up the possibility to involve non-researchers in a more active sense, despite the assumed onus on professional practitioners to instigate engagement exercises by *sharing* benefits with a (homogeneous) public. The engagement goal is for both researchers and research participants to benefit from their interactions, thus moving away from the earlier viewpoint of knowledgeable research experts fixing problems on behalf of wider society. Although there is a much more even tone in the rhetoric, improvements are still required in public engagement broadly (Stilgoe *et al.* 2014, Sturgis 2014), including a need to consider how publics[7] engage on their own terms rather than solely through exercises established by policymakers (see Pallett and Chilvers 2013, Chilvers *et al.* 2018). As one response to instigate collaborative engagement, UK Research and Innovation[8] recently announced a pilot funding call to support engagement with underprivileged communities (UK Research and Innovation 2019), thus making the role of non-researchers more prominent by starting the engagement process from their needs and interests rather than solely from the researchers' perspective.

1.2 Important contributions from childhood studies

The main driver for this thesis is exploring public engagement with science, however my specific focus on young people means the field of childhood studies is greatly significant. Despite concerns around the existence of discipline-based silos ignoring each other within childhood studies (Punch 2019), the advantages of

[7] 'Publics' is preferred here over the term 'public', as the latter obscures the diversity inherent within society; a point reflected on further in section 2.3.2.
[8] UK Research and Innovation is the umbrella organisation of the UK's research funding councils.

drawing upon childhood studies for my thesis are precisely found within its interdisciplinarity: the complexity of the social requires theories from science and humanities to be brought in to childhood research (Prout 2011). Therefore, childhood studies is an umbrella of traditions involving psychology, sociology, anthropology, human geography, law, economics (Woodhead 2008, Morrow 2011). The core priorities of contemporary childhood studies are the perspectives and experiences of children and young people within diverse historical and geographical contexts (Konstantoni and Emejulu 2017).

However, it has not always been this way. As with public engagement, there has been an extraordinary shift in the foundations of childhood research in recent years. For the majority of the 20th Century, childhood research was conducted through the discipline of developmental psychology (Woodhead 2008), which was heavily influenced by biological research methodologies and the search for objective truth (Prout and James 1997). In particular, the focus was on predictions of child behaviour at different 'stages' of their development, primarily indicated by the age of the child (Kehily 2008, Morrow 2011)[9]. Within this research tradition, adults dominated: they observed children and drew their conclusions independently of the children they studied (Mayall 2000, Woodhead and Faulkner 2000). Children were granted only a passive role in adult-shaped research agendas (Woodhead 2008). To sum, there was no space or interest in the views of children during this phase.

As the century progressed, so other disciplines began to expand perceptions away from the idea of a singular child or childhood (Prout and James 1997). Social anthropology challenged the universality of the notion of stage-based development of the child, by drawing attention to the diversity of childhoods (over different times and locations, e.g. Rwezaura 1998 for an exploration of childhoods in sub-

[9] As Woodhead (2008) suggests, stage-based development is still a strong notion in Minority World societies – adults frequently ask children for their ages and then make assumptions on the child's competence – while other region do not experience this so much: many Bangladeshi children do not know their ages, so adult expectations depend on gender and family circumstances.

Saharan Africa) and emphasised the importance of ethnographic exploration to improve understandings of children (Kehily 2008, Morrow 2011). Sociology offered significant impetus by expanding its interest away from the socialisation of children – how they learn to successfully interact with the world around them – to understanding children as they are now and not just what they will be in the future (Prout and James 1997, Morrow 2011). As such, in contrast with early developmental psychology approaches, which positioned children and young people as passive entities to be investigated, there is far greater recognition of their agential potential (James 2009): they are capable of being active contributors throughout the research process (Reynaert *et al.* 2009, Davis 2011, Wyness 2013). Human geography turned towards childhood as an area of interest, building on the contributions of anthropology in exploring the physical (e.g. rural / urban) and digital places and spaces that children occupy (Morrow 2011). Increased attention was also given to policy and practice (Woodhead 2008), for example, through attending to the notion of children's rights and how these are implemented in different societies (Tisdall *et al.* 2008, Lundy and McEvoy 2012, Mayall 2012).

Following these developments and the successful combining of different disciplines, the field of childhood studies provides rich perspectives in the study of children and childhoods (Kehily 2008). Therefore, since the views of children and young people have been ignored within public engagement with science scholarship, except for a small number of articles (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015), debates from childhood studies offer crucial inputs for my thesis. Much has progressed within childhood studies to overcome the marginalisation of children and young people from research into children and childhoods (Kehily 2008). It is now time for public engagement with science to follow this lead and pay greater attention to the younger section of society which it currently overlooks.

1.3 My work context and the drive for my research

This project was based at the University of Edinburgh's College of Science and Engineering, within which numerous activities and events are delivered to engage young people with science and science-related disciplines. The engagement focus of this College, and the changes to my role during my PhD study, have significantly contributed to my research foundation. Within a central College Office, my work-role exists in the College Engagement Team, the aims of which are now guided by a renewed public-engagement strategy confirmed in October 2015 (i.e. during the course of my research), with my work priorities shifting during the course of my research.

Back in 2013, when I started my research, my focus was solely on the SCI-FUN Roadshow[10]: a mobile science centre project (consisting of hands-on activities) that visited early secondary school pupils and community events with the support of the College's students. At this point, after three years of primary school teaching, and seven years of the SCI-FUN Roadshow, I started to seriously reflect on my engagement practice: although most people reacted positively, were there alternative strategies or preferences to which I was blind when developing science experiences for children and young people? ('Science experiences' here is a broad term I use to include any activity, programme, event, or process, which has science or science-related themes – like engineering – at its heart.) This raised questions for me around the evaluation strategy I had developed for SCI-FUN: were short paper-based questionnaires the most appropriate way to obtain feedback from the early secondary school pupils we were mainly engaging?

More recently, my role has evolved to include other responsibilities: I manage or co-manage other events aimed at different publics (e.g. Doors Open Day at the King's Buildings[11], Science on a Summer's Evening[12]) as well as provide support to

[10] Further details about the SCI-FUN Roadshow project can be found at www.scifun.ed.ac.uk
[11] https://www.ed.ac.uk/science-engineering/news-events/doors-open-day-at-kings-buildings
[12] https://www.ed.ac.uk/science-engineering/news-events/science-on-a-summers-evening

colleagues (e.g. sharing event and training opportunities, developing relationships with external organisations, offering advice on public engagement approaches and proposals). I also chair the College's Public Engagement Advisory Group which is comprised of colleagues involved in public engagement: many members have coordinator roles where they interact directly with different publics, whilst others are in administrative roles to support academic researchers[13]. This group seeks to develop and address College-specific public-engagement priorities, from formal recognition of engagement efforts through to producing exemplars of practice to inspire others.

With the expansion of my responsibilities in supporting public engagement efforts across the College, focusing only on the evaluation of SCI-FUN seemed too limited. Instead, I desired a broader approach that explored young people's perspectives around how they engage with science. This type of exploration would enable building on my previous in-depth experience, and be beneficial for my College's engagement practice – much of which involves children and young people[14] – not just my own. Therefore, after a period of negotiation with College management, an agreement was struck to instigate the Young SAGE (Science Advisory Group for Engagement) group that would involve 8-10 local young people (16 – 18 years old) with whom I would collaborate. Our collaborative working from late 2016 to summer 2018 provides the foundation for tackling the relative absence of attention on public engagement with science involving young people, and provides the foundation for my thesis.

1.4 Structure of this thesis

Following this introductory chapter, in chapter 2 I offer a review combining the salient aspects of public engagement with science in parallel with childhood studies.

[13] Academic researchers have also been part of this group previously, but none are part of the group at the time of writing.
[14] As evidenced by the annual HE-BCI Survey submissions that I coordinate for the College: see https://re.ukri.org/knowledge-exchange/the-he-bci-survey/

I start by focusing on three modes of engagement that are relevant to both fields – communication, consultation, and participation – and in so doing, I illustrate how similar developments and debates have arisen in these distinct academic arenas. I then move to examine the concepts of agency, expertise, and diversity and how these have affected the foundation of research in each field, and how these are relevant to the notion of intergenerational collaboration and project ownership. The chapter concludes by bringing together the gaps identified during the review, followed by the research questions for my study.

With the research focus set, chapter 3 presents the methodological foundation for this study. I initially outline my critical realist approach towards a co-production case study focused on the Young SAGE project. I then reflect on different facets of the case study: recruiting young people and the methods employed – particularly the use of my reflective research diary and my participant-observer role in the in-person Young SAGE gatherings. (I deliberately chose the term 'gatherings' instead of 'meetings' to reflect a less formal, and perceptually more collaborative, basis for the project.) Following discussion around ethics (including informed consent), I outline my thematic analysis approach (Braun and Clarke 2006).

Chapters 4 and 5 focus on the practice of intergenerational collaboration. In chapter 4, I delve into the challenges for the adult researcher in working in a participative way with young people that conspire to restrict the level of participation to which young people can aspire within a formal collaboration. Several markers of difference both within and beyond our intergenerational interactions are highlighted. I also provide a reflexive view on how my work-role and PhD statuses played taxing roles in my own expectations and actions. Finally, I draw attention to the tensions between supporting the project and my perceived and actual responsibilities at specific project pressure-points.

To illustrate how to address these researcher challenges, Chapter 5 utilises and builds on the foundation of Hanauer *et al.* (2012), and their focus on undergraduate studies, to explore ideas around project ownership. Prioritisation was required at

first towards fostering a sense of ownership within the participants, in order to avoid a perception of the project being mine and mine alone. I then explore how ownership developed from this foundation, and illustrate the diversity of roles that participants played as the project unfolded. I close by elaborating on the tensions around different perspectives on what the idea of ownership entails, and how this provided further challenges to my contributions to the project.

Chapter 6 shifts the focus by bringing the participants' perspectives on science experiences into view. At first, I explore the dimensions of science experiences that affect the appeal for young people and consequently how they engage. Then, I draw out nuances around the role of choice within these experiences: how they can potentially heighten the motivations of those involved, as well as illustrate how a lack of choice may not be completely negative. I conclude this chapter through examining the primary drivers of science experiences expressed by Young SAGE participants, and draw attention to the possible obstacles that need to be considered in encouraging young people to be involved within participative public engagement with science exercises.

Finally, chapter 7 summarises the key findings of my research and responds to the main research questions developed earlier in the thesis. I then suggest the implications of my work for the academic literatures, policymakers, and practice, before offering ideas for further research that would address remaining gaps in knowledge.

As this introduction indicates, my research has taken an interdisciplinary approach with either public engagement with science or childhood studies (or occasionally both concurrently) being brought beneficially into discussions. This foundation is reinforced by reviewing these literatures, which is where my thesis now turns.

2 Engaging young people: integrating salient debates from public engagement with science and childhood studies

In this thesis, I weave together debates from public engagement with science and childhood studies to establish the gaps in knowledge around young people's involvement within public engagement with science. In so doing, I respond to Punch's (2019) appeal that childhood studies debates and learning should be applied within other disciplines. Initially, I navigate current perspectives on three prominent modes within public engagement – communication, consultation, and participation (Rowe and Frewer 2005) – and highlight the lack of attention on young people's perceptions about these modes and their voices within these debates.

Then, I delve further to illustrate how focusing on a project's purpose provides the foundation for decisions on incorporating the agency, contributory expertise, and diversity of those involved, aspects that are significant within academic debates. These project dimensions directly influence how to explore young people's perspectives: for example, who is 'allowed' to participate and what are the barriers that exist?

Tensions around young people's participation lead onto the notion of intergenerationality (Mayall 2012, Wyness 2013), primarily interactions between adults and young people, with a particular focus on issues of power and how power is not an entity in itself, but a relational idea in which actions and reactions are of key importance (Foucault 1980, Gallagher 2008). Based upon normative expectations of adults being in positions of authority (Vanderbeck 2007, Taft 2015), the inescapable presence of power dynamics within an intergenerational context are illustrated.

In the final part of this literature review, I summarise the identified gaps in the literature and put forward the related research questions that this study explores.

2.1 Modes of engagement: communication, consultation, and participation

This section focuses on three modes of interaction that are significant within both the field of public engagement with science and the childhood studies field: communication, consultation, and participation. Conceptualising 'engagement' as encompassing these three modes conflicts with some public engagement with science writers, who perceive 'engagement' as a synonym for 'participation' (see Delgado *et al.* 2011). However, as a public engagement practitioner in a working context where I usually instigate projects rather than react to specific needs beyond my university, Rowe and Frewer's approach (2005) of focusing on the primary flow of information between the involved parties reflects my experience. Furthermore, by considering engagement as establishing "…a meaningful contact or connection…" (Oxford Dictionaries 2015) – supported by the notion of engagement requiring "…mutual benefit…" (The National Co-ordinating Centre for Public Engagement no date) – participative exercises are not the only domain in which meaningful, mutually beneficial interactions happen. Not including communication and consultation within the scope of the term 'engagement' denigrates these modes by implying they are not meaningful or beneficial at all for those taking part.

For me, the notions of communication, consultation, and participation offer useful structures through which to explore wider engagement. As previously suggested, these notions are defined by the information flow between those involved:

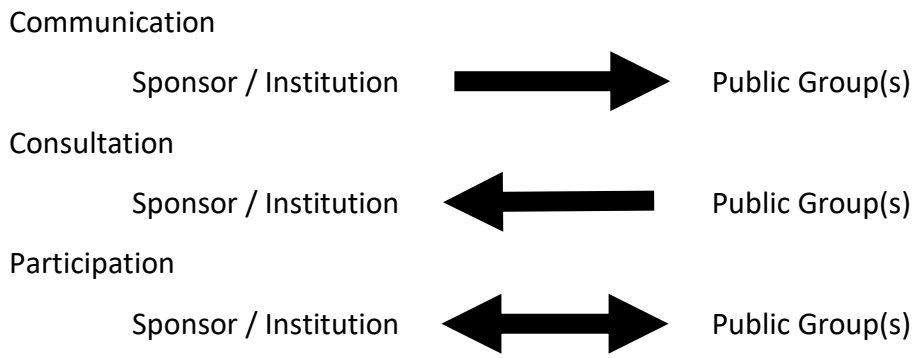

Figure 1: Information flows in public engagement with science exercises. Adapted from Rowe and Frewer (2005)

This foundation has been built upon in the form of The Public Engagement Triangle (Science for All 2010)[15]:

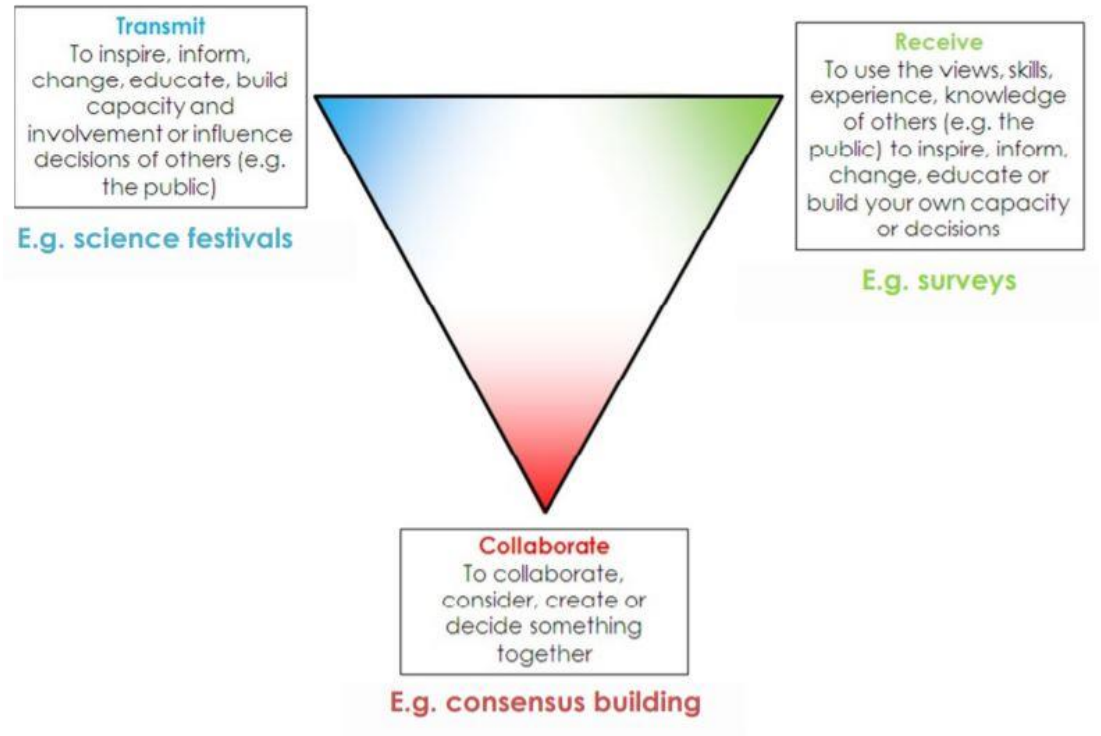

Figure 2: The Public Engagement Triangle, Science for All (2010)

Here, 'transmit' is equivalent to communication, while 'receive' maps onto consultation, and 'collaborate' is the equivalent of participation. Considering these three modes of engagement is now well-established in practice.

Within the discussion of each engagement mode in the following sections, the integration of perspectives from public engagement with science and childhood studies illuminates how key debates in each are mirrored (e.g. parallel debates about deficit models), as well as revealing opportunities for research combining these fields (e.g. how young people can be engaged). Additionally, since children and young people have been greatly ignored within public engagement with science

[15] The Public Engagement Triangle concept was originally developed by Sciencewise and has been taken on by the National Forum for Public Engagement with STEM in which the National Co-ordinating Centre for Public Engagement is a key participant, see: https://www.publicengagement.ac.uk/nccpe-projects-and-services/nccpe-projects/national-forum-public-engagement-stem/purposeful-public-engagement-with-stem

literature, I incorporate occasional insights from studies on informal science learning (i.e. non-school-based learning experiences, such as those found in science museums and science festivals).

2.1.1 Communication and deficit models: covering the same ground?

Communicative public engagement with science (frequently termed 'science communication', see Burns *et al.* 2003, Cortassa 2016) involves knowledge being passed from the scientific community to the public in a unidirectional manner (Rowe and Frewer 2005). Unlike the other modes, there is no explicit interest in public opinions on this information. Early public engagement with science research was based on the premise that any concerns in engagement exercises resulted solely from issues with the public, rather than any scientific aspects (Wynne 1995). In these initial stages of scholarly attention, the field itself was termed 'public understanding of science' (see Wynne 1995), which reflected the problematisation only of the public rather than any issues with the role of science and scientists (Wynne 1992b). That the terms 'public engagement' and 'public participation' were only used in one 'Public Understanding of Science' article in 1992, yet 43 articles in 2011, serves to illustrate how academic attention on the role of publics within science has diversified since these early days (Sturgis 2014).

Consequently, there are tensions around the purposes of communicative engagement. This mode is often linked to the notion of the *deficit model* (Bucchi and Neresini 2007, Stilgoe *et al.* 2014), which has been insightfully criticised for many years (Ziman 1991, Wynne 1992b, Gross 1994, Cortassa 2016). The deficit model of public engagement with science positions a homogeneous general public as a passive receiver of information with little scientific interest before they are engaged[16]. Therefore, the defining implication is that transmitting more information results in new or improved public understanding that will deliver a (more)

[16] However, in a bizarre twist, it has been argued that the surveys upon which this characterisation evolved suggested that people actually claimed that they were interested in science (Ziman 1991).

favourable attitude towards the scientific ideas being presented and science more generally (Wynne 1995, Bucchi and Neresini 2007: 450); a sentiment at the heart of the Bodmer report for the UK's Royal Society in 1985 (Short 2013). Despite the long-standing criticism of this view, the deficit model approach continues to exist (Cortassa 2016): for example, a study involving a small group of plant scientists illustrates their concerns for the image of science in wider society (Mogendorff *et al.* 2012).

The notion of deficit models has also caused debate within childhood studies. For example, Matthews (2009) asserts that a Piagetian view of a stage-based approach to cognitive development represents a deficit conception of childhood. Instead of merely having less information, children are instead perceived as lacking the cognitive ability to comprehend topics, therefore positioned as incompetent and incomplete humans. Matthews (2009) argues there is a general awareness that this is not always true, offering the widely accepted belief that children are usually better at learning languages than adults (Hartshorne *et al.* 2018), but the overall deficit conceptualisation remains dominant nonetheless. Furthermore, it has been suggested that adults usually perceive young people as passive, subordinate members of contemporary society that depend on adults, based on a stance of lacking social capacity and existing in a limited frame of interaction (i.e. only parents, teachers, guardians, etc.) (Qvortrup 2005, Cairns *et al.* 2018: 40-41). This homogenised positioning of young people in childhood deficit models reflects the notion of a singular public (as opposed to publics) in the deficit model of public engagement with science. Both depictions are distinctly negative, based on problematic assumptions that young people and public groups respectively have limited capacities and are consequently unable to actively contribute to issues in wider society or science.

Thus, one risk of deficit model approaches is the associated exclusion of perspectives that may otherwise offer constructive insights. Within a context where science knowledge is contested, Wynne (1992a) highlights the risks of assuming

public ignorance through his seminal assessment of scientists interacting with the local farming community in Cumbria after the Chernobyl nuclear disaster in the late 1980s. Here, the scientists attempted to control all variables without considering any further influences (i.e. farming requirements). Consequently, they either chose to actively disregard or passively ignore the relevant knowledge of the local farming community (e.g. insisting on the moving of livestock despite the locally known negative impact on feed levels in subsequent years). As a result, once further errors were uncovered – such as the scientists' claims that all radioactivity readings were caused solely by the Chernobyl release, when in fact it was only 50% – this contributed to tensions between the scientists and the local community, with the latter becoming dissatisfied with the actions of the scientists:

> …the farmers felt that their whole identity was under threat from outside interventions based upon what they saw as ignorant but arrogant experts who did not recognize what was the central currency of the farmers' social identity, namely their specialist hill farming expertise. (Wynne 1992a: 295)

This example neatly highlights the dominant position of the science, regarded as the key source of knowledge for the nuclear contamination issue above all other concerns. The scientists did not entertain the idea of seeking contributory knowledge from the local farmers, and actively dismissed any suggestions from them seemingly based on assuming their ignorance of science, a key aspect of the deficit model (Michael 2009). This type of boundary work (Gieryn 1983) between science and non-science concerns can, for example, result in issues of trust between representatives of science and wider society.

A further issue of the deficit model is its founding on the basis of the context-free application of scientific knowledge: it may be that rather than not knowing an abstract scientific fact, non-specialists place science alongside other forms of knowledge and values in making their assessments of science-related situations (Yearley 2005a). As well as the reflection on Cumbrian farmers (Wynne 1992a), Yearley's (2005a) analysis of the UK's Bovine Spongiform Encephalopathy (BSE)

crisis in the 1990s is particularly helpful: the widespread concern around the transfer of BSE to humans was not caused by an understanding (or not) of the disease and how it resulted in specific symptoms and effects, but rather a judgement on how slaughterhouse operators could or would adhere to safe working conditions to prevent the disease entering the food chain. In terms of trust then, the focus is not so much on the science, but on the practical application of it.[17] Rather than following the deficit-model assumption of passive non-specialists, these examples of the Cumbrian farmers and BSE crisis actually highlight how public groups have their own motivations and interests, driven in both cases by exposure to risk.

Therefore, the motivations – and consequent permissions – for non-specialists to be involved in science and science-related situations is an alternative lens through which to view communicative engagement practice. For example, science festivals appear to be particularly welcomed with some researchers claiming these are increasing in popularity (Bultitude *et al.* 2011, Fogg-Rogers *et al.* 2015). The majority of science festivals enable the communication of scientific concepts, such as through interactive hands-on activities (Bultitude *et al.* 2011, Jensen and Buckley 2014), thus replicating what happens in science-centre contexts (Tlili *et al.* 2006)[18]. Within these events, single communicative experiences are argued to have more affective impacts, beyond the recall of basic facts, which potentially stimulate engagement with related experiences (Dhingra 2006, Stocklmayer *et al.* 2010). Therefore, as exercises that enable access to science knowledge, or provide possibilities to spark or foster scientific interests, communicative engagement

[17] There is also a potential role here of specific policymakers and how these are trusted by society, or not as the case may be. In contexts like the Chernobyl fallout in Cumbria and the implications of the BSE crisis, it is difficult to completely delineate the separation between science and policy.

[18] Most interactive activities are centred on transmitting information, however Fogg-Rogers *et al.* (2015: 3) state in their literature review that: "It is notable that scientists applying to take part in science festivals in the United Kingdom are now mainly encouraged to develop hands-on activities enabling two-way dialogue and interaction with the public." Although interactive activities can facilitate interaction primarily through discussion, the capacity to enable dialogue that provides "…insight[s] into citizens' views, concerns and aspirations on issues relating to science and technology" (Sciencewise, no date) is arguably a limited part of the engagement.

appears to meet a need. However, there is a chance that these practices are concurrently maintaining the status quo: reinforcing the special nature of scientific knowledge and therefore contributing to the boundary-work of science (Gieryn 1983).

Thus, there is a need to explore what the communicative mode of public engagement means for young people, in terms of either offering positive opportunities to discover more information; negatively maintaining a distinct status for young people that restricts their options for contributing to scientific progression; or a situation-dependent combination of these possibilities.

2.1.2 The challenges for consultation

The communicative mode is the engagement format with which the majority of scientists are most familiar, and arguably most comfortable, especially when initially becoming involved in public engagement exercises (Davies 2008). However, there seems to be greater delivery of discussion-based engagement activities where different perspectives are included (Bultitude *et al.* 2011). Furthermore, particularly for scientists with greater experience of working with non-scientists, there is emerging evidence of some scientists being open to consultative (as well as participative) engagement in order to include the views of publics within the scientific process (Davies 2008). Within science centres, there are also accounts of diversifying engagement approaches beyond purely the communication of science knowledge and the scientific process: for example, Tlili *et al.* (2006) describe dialogic workshops that enabled perspectives to be shared between policymakers, academics, and community members on science-related topics. Although practical issues resulting from power dynamics are explored later in this chapter, attempts to bring together alternative perspectives suggests a movement away from scientists and communicators of science only regarding publics as a passive element in the engagement process.

The recognition of positive contributions is further illustrated by consultative engagement with science exercises, where initiators (i.e. funders and practitioners, as well as scientists) seek views upon a given topic through an unidirectional flow of information originating from publics (Rowe and Frewer 2005). A similar conception exists in childhood studies, where consultation has been simply defined as "…finding out views in order to inform decisions" (Hill 2006: 72). Therefore, consultation seeks a more involved role for those engaged in comparison with the communicative mode, although the responsibility for any outputs remains steadfastly with the initiator. Therefore, careful attention to the development of consultative engagement exercises is necessary to avoid biasing or intentionally obscuring the views of those involved, such as selecting comments that agree with a conclusion that has been pre-defined.

Taking an example from public engagement with science, some minor information exchange to establish a foundation may take place during consultation exercises, but the science representatives (i.e. the engagement initiators) retain a more powerful role throughout the process (Palmer and Schibeci 2012). A significant example is the UK's Public Consultation on Developments in the Biosciences, which aimed to include public views in policymaker decisions surrounding new bioscience developments in the late 1990s (Irwin 2001). The initiators' powerful position is highlighted by decisions made around the final report, which deliberately ignored the more extreme opinions voiced during the original meetings from people with pre-existing views (Lezaun and Soneryd 2007). Further to deciding who is heard, Irwin's (2001) insightful critique also draws attention to the difficulties in eliciting genuine perspectives from non-scientists. In his analysis, the informing stage for participants was potentially too influential since "…the selection of what counts as hard fact represents an inevitable judgment on the part of the exercise's promoters" (Irwin 2001: 14). The presentation of 'facts' from exercise initiators may be overly leading for non-scientists: the privileged status that scientific knowledge has established in the Minority World (Yearley 2005c) may dissuade many non-scientists from critiquing any introductory information. This influence may

consequently skew the views of non-scientists, endangering the genuine nature of complementary views that exercise initiators seek.

Similarly, the potential for exercise initiators to overly influence the views of those engaged may be encountered in consultative research with young people: there is a need to strike a balance between informing and leading. For example, the use of non-neutral statements by facilitators during consultations with children and young people are argued to be particularly influential on subsequent statements by those involved (Fargas-Malet *et al.* 2010). Additionally, based on normative motivations to care or protect young people, adults can make decisions without appropriately involving young people's views in the process (Qvortrup 2005). For example, within disability studies, Davis (2011: 86) asserts that "in the main, adults are deemed 'experts' and children are assumed to be unable to put forward their own solutions to their own life problems." Depending on the specific interactions during the consultative process, similar stances can exist in overlooking the views of young people in general, leading to missed opportunities to look critically at programmes aimed at young people.

While consultation offers an approach that positions those being consulted as knowledgeable contributors, there remains practical challenges around eliciting and preserving their contributions through the process. The onus is on initiators to ensure that they appropriately bring together the diversity of views shared in order to enable suitable decisions. Furthermore, the above examples from public engagement with science and childhood studies illustrate some of the obstructions in terms of deciding whose perspectives are included, as well as how those involved in consultative processes – adults and children – can be influenced by exercise initiators. Therefore, in a similar manner to communication, there is an opportunity to explore young people's perspectives on consultative approaches, including whether the claims of successfully securing views are shared by young people or whether these exercises are perceived as too leading, threatening the insights that ought to be revealed.

2.1.3 Participation: the contemporary moves in both public engagement with science and childhood studies

The concept of participation has received considerable attention and scholarly encouragement in public engagement with science as well as childhood studies, where it has been described as a "mantra" (Punch 2016), and an "ever-present theme" (Cairns 2006). Participation involves the sharing of views between different parties with all benefiting from this exchange (Rowe and Frewer 2005), with the United Nations Convention on the Rights of the Child (UNCRC; United Nations 1989) reflecting this definition by emphasising how children's participation should enable them to express their views and for these inputs to be genuinely impactful (Lundy and McEvoy 2012). The notion of participation has significant nuance: within childhood studies, this is suggested by different typologies that reflect the level of involvement of participating children and young people (e.g. Hart 1992, Shier 2001).

2.1.3.1 Revealing new perspectives and building trust through participative relationships

Within public engagement with science, participation is described as a bidirectional flow of information between the public and the initiators of the exercise leading to all parties developing their views (Rowe and Frewer 2005). This process can also be termed 'deliberative', where there is a genuine exchange of information between scientists and non-scientists and all contributions are given equal weight (Palmer and Schibeci 2012). This potential for sharing equally respected perspectives can be attractive, however – just like consultative approaches – achieving an 'equal' sharing of views depends on the agency and power dynamics of those involved in the exercise.

Furthermore, it is argued that participative engagement enables the recognition of expertise from different domains (e.g. social, economic, etc.) which improves the review of technical knowledges and opens up genuine debate (Evans and Plows 2007). Advisory groups are one example of participation, such as for the UK Biobank

in which a council of publics aims to provide outside perspectives of biomedical innovations in order to reflect the evolving norms of society at large (Harmon *et al.* 2013). However, as suggested by Lezaun and Soneryd's (2007) critique of whose voices were included in the GM Nation reports, the identities of those involved in the advisory group impacts on the perspectives that are heard. The membership of the UK Biobank's Ethics and Governance Council[19] appears to have a significant academic slant currently, therefore the extent to which this group appropriately provides the perspectives of wider society is questionable (see Sturgis 2014).

Debates within the public engagement with science literature have encouraged greater focus on the governance of science (e.g. Pallett and Chilvers 2013). This focus is particularly significant given the establishment of science as the leading source of knowledge in the contemporary world (Yearley 2005c), based on successful boundary-work that questions the significance of other forms of knowledge (Gieryn 1983) and attempts to allow only scientists to comment on the place of science in society (see Lock 2016).[20] However, Jasanoff (2004) suggests the field of science cannot work independently, and has argued for a reintegration of science and society perspectives, in order to improve knowledge (Mahony and Stephansen 2016) through incorporating contributory expertise from complementary domains. Furthermore, Sturgis (2014) claims that dialogic approaches (Sciencewise no date) reduce controversy and increase trust.

However, rather than concerns for public trust in science itself and the inherent uncertainty around new knowledge (Wynne 2001), the issue in wider society is suggested to be more around interactions between science and other societal issues (e.g. generalised mistrust of large organisations, science going beyond its remit, and the future use of data for commercial gain, Haddow and Cunningham-Burley 2008). Similarly, the capacity of dialogic engagement to inform decision-

[19] For a current list of members, see: http://egcukbiobank.org.uk/Members

[20] A summary of the argumentation of the special status of science – and the flaws within this argument – is provided by Yearley (2005c). For example, data is supposed to be value free, but human interpretation of data brings personal values back into the analysis.

making around scientific progression has also been questioned. From an Austrian perspective, participants in Felt and Fochler's (2008) case study were positive about the possibility to highlight potential societal concerns to scientists, and enhance the flow of information beyond the scientific community, but they had little confidence in both their influence on governmental processes and how these same governmental processes regulated scientific innovation. Thus, although a principal driver for the incorporation of multiple perspectives on particular science-related concerns is to better ensure the realisation of societal benefits, there are other agendas in play. Combining science expertise with other societal perspectives may well offer great promise, but this amalgamation does not exist in a vacuum and needs to be accepted by other actors, such as governmental, in order to be suitably acted upon.

2.1.3.2 Benefits and challenges of participation

Recently, the promotion of participation has been pervasive within childhood studies, based on recognising that young people have their own views, which can be advantageous in the assessment and improvement of services related to them (Davis and Smith 2012). On the one hand, when genuinely integral, participatory mechanisms involving young people have great promise, since young people have specific knowledge about their lives (Mayall 2000, Grover 2004), which is inaccessible to adults directly. Additionally, the knowledge gained or developed can improve understandings and outline alternative possibilities for innovation centred on young people's interests and views (Tisdall *et al.* 2009). In addition to these project-focused benefits, some scholars also suggest that participants can themselves benefit through, for example, developing personal attributes including teamwork skills; enhancing self-esteem; having an increased sense of belonging; and improving career prospects amongst other possibilities (Shier 2001, Tisdall *et al.* 2008, Davis 2009, Wyness 2009).

On the other hand, participatory approaches in engaging children and young people do not always result in these attractive benefits. Some critics contend that beyond personal benefits (e.g. learning, experience, confidence gain), it is difficult to see how participative structures involving children and young people (e.g. UK Youth Parliament, local youth forums, school councils) have made a difference to wider society concerns (Percy-Smith 2010). This lack of society-level impact is partly due to the power dynamics between different participants, such as (adult) service providers and the young people involved (Percy-Smith 2010), particularly in terms of who makes the final decisions (Cairns 2006, Thomas 2007). Furthermore, echoing issues of representation within participative public engagement with science exercises (Sturgis 2014), Lewars (2010) questions the capacity of elected pupil groups to reflect the composition of their peer-group, since participants are likely to be more well-behaved and academically inclined. This view resonates with school-council involvement appealing to more confident and articulate young people (Hill *et al.* 2004), with those who are perceived as more academic seemingly given greater opportunities to offer their views (Cairns *et al.* 2018). In addition, children and young people participate in a variety of ways in their everyday lives and settings (Malone and Hartung 2010). However, incorporating their involvement within unfamiliar adult-led agendas can limit genuine participation (for an argument related to the research context, see Powell and Smith 2009); be unappealing for some young people who prefer to spend their time away from adult control (Reynaert *et al.* 2009) and restrict co-productive working (Davis and Smith 2012). Participation is therefore a mode of engagement that has the potential to realise a variety of benefits, but is not a panacea that guarantees young people's insights.

Beyond focusing on the involvement of young people in participatory processes, a further aspect gaining increased attention is that participating adults themselves may be subject to external influences. For example, within a school context, teachers involved in pupil councils may be limited in the decision-making options that are available for pupils (Taylor and Robinson 2009). This restriction echoes the influence of formal ethics requirements that are required within research

institutions (Lohmeyer 2019), which rightly aim to avoid the exploitation of those involved in research, but also negatively affect the potential scope of participation (Daley 2015).

In order to promote the benefits of participatory processes and overcome its challenges, based upon the work by Lansdown (2001), Davis (2011) suggests the following key commitments for participatory projects involving young people: be relevant to the young participants; have the opportunity to affect change; be adequately resourced; have defined and realistic targets; incorporate trust and respect between participants; and have training available to the participants to enable valuable contributions by all parties. Although these commitments have been argued for processes involving young people, these could easily apply to all participatory projects, including those within public engagement with science. However, being participatory requires opening up the process and sharing project ownership with participants, and so many of the above commitments need exploring with all those involved, rather than imposing pre-determined decisions in an autocratic manner. For example, the relevancy of a topic should not be decided on behalf of participants in advance, since this pre-emptively curtails where young people's perspectives may offer positive contributions.

2.1.3.3 Preparing participants for participation

Within the critique of requirements for successful participatory projects, the provision of participant training has rightly been the focus of significant attention. For example, within citizens' juries, it is deemed important for those involved to have time and training to engage with the science at the heart of the process, since they can otherwise lack the knowledge to sufficiently contribute to the dialogic exercise (Evans and Plows 2007). A similar stance is advised by many researchers within childhood studies (e.g. Kellett 2011, Davis and Smith 2012, Ozer *et al.* 2013, Bradbury-Jones and Taylor 2015): training suitably prepares the young participants for the projects in which they are involved. Some justify the need for training by

suggesting it can address power imbalances between all participants, including the adult researcher, by ensuring everyone has the same basic foundation for the collaborative exercise (Cahill 2007). However, others argue that the provision of training can be an additional barrier for those who are less academic as well as encourage participants to approach the project like an adult researcher (Brownlie *et al.* 2006). This critique is built on by Kim (2016: 232), who argues that:

> …not taking such views [on the nature of knowledge] into account may mean that children's research is likely to be subject, either unwittingly or overtly, to the epistemological perspectives of the adults who provide the training and/or support throughout their research processes.

Therefore, decisions about training participants reflect the concerns expressed earlier regarding consultation exercises and the potential for deliberately or inadvertently leading those involved. Rather than blindly accepting training is always required, researchers may need to consider its suitability for their own projects. For example, Holland *et al.* (2010) did not train the participants for their research into the lives of young people who were in local-authority care, as they wanted participants to be creative in their explorations and decided that formal training would be opposed by their participants, who appeared to react more positively to informal engagement. Also, the young co-researchers in Cairns *et al.* (2018) utilised adult-free discussion spaces for young people based on their previous experiences of running such events; there were not trained in how to prepare and deliver these experiences. Therefore, the provision of training for participants should not be assumed, since it may not deliver the benefits some suggest. Moreover, by imposing training, the researcher is already making decisions on what is best for the group, which contravenes the intention of participation: a two-way interaction with all perspectives respected. Consequently, the provision of training arguably needs to be judged on a project-level basis, with the decision shared by all involved.

2.1.3.4 Brief discussion about participation

Overall, there is a need to explore the extent to which participatory processes genuinely achieve the benefits that have been widely claimed, such as improvements in the relationship between science and society, as well as services for young people. Although there is a great deal of policymaker and scholarly promotion of participatory engagement within both public engagement with science and childhood studies, there is a tension regarding the needs and preferences of young people. Specifically, the tension – aligning with those previously identified for communication and consultation – is in whether young people actually want to be involved in participatory processes and, if they do, whether they experience the positive benefits in the manner that is frequently proposed. On a wider note, there is also a need to explore whether the participation of young people leads to meaningful contributions and what barriers exist that limit these impacts.

2.1.4 Discussion

This section has explored different modes of engagement based on the typology advanced by the public engagement triangle – communication, consultation, and participation – and highlighted key insights from the literatures of public engagement with science and childhood studies. At first glance, a focus on the flow of information within these engagement modes makes them seem unproblematic. However, through my discussions in this section, I have brought into focus the complexity inherent in each approach.

Firstly, communication could be a misplaced attempt to gain public favour and increase interest or perceived more positively by citizens as a mechanism to share knowledge. Secondly, consultation may actively inform the scientific process, but it could also be a mechanism that gives the illusion that societal views have contributed. Finally, participation is a multifaceted process that might enable other perspectives to be included at a deeper level as well as achieve benefits for those

involved and society at large. Alternatively, participation may offer much but deliver little due to powerful initiators imposing terms from the outset (e.g. provision of training), thus limiting the scope for participant insights.

Attention has been given to the three engagement modes within each of the distinct literature areas, and somewhat surprising parallel debates in some specific areas, such as deficit models and the increased focus on participatory approaches, have been highlighted. However, there is a significant absence of research into public engagement with science as it pertains to children and young people. Aside from feedback related to specific communicative projects (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015), there is a lack of understanding of how young people desire to engage with science. More specifically, there is a complete absence of young people's perspectives across the spectrum of public engagement with science formats, both in terms of preferences for and within each mode, as well as perspectives around the contributions young people can meaningfully make to public engagement processes.

2.2 Engagement mechanisms and the complexity of participation – what is the purpose?

Although greater focus has been on participation as a key engagement mode, it is detrimental to perceive a hierarchy of modes with communication and consultation as somewhat poorer relations. For example, in the presentation of The Public Engagement Triangle, a hierarchical mentality is explicitly avoided, with the authors instead sensibly encouraging attention on the purpose of the engagement (Science for All 2010). In addition, they suggest there could be potential overlaps between the different formats. So, in a discussion instigated by a hands-on activity in a science festival for example, the main purpose of the engagement may be to impart scientific knowledge to visitors, who may also provide a view that encourages the scientific researcher to reflect on an aspect of their work differently.

However, while there should not be a hierarchy of engagement modes, the proposals for distinct sub-stages within participation illustrates the diverse variety in which participation can be enacted. One of the most influential frameworks of participatory processes is suggested by Hart (1992). In this proposal, Hart (1992) employs Arnstein's (1969) notion of a participatory ladder relating to the power dynamics involved in urban-development programmes within his own model that addresses projects involving children and young people outside of a family context. However, in a departure from Arnstein's equivalent, Hart's top rung of the ladder (level 8) describes a collaborative basis between young people and adults with level 7 being where young people are in complete control of the project. As Hart himself later justifies, this reflects his belief that citizenship – where power is shared and other perspectives recognised – is where the ultimate control of projects should reside:

> The highest possible degree of citizenship in my view is when we, children or adults, not only feel that we can initiate some change ourselves but when we also recognise that it is *sometimes* appropriate to also invite others to join us because of their own rights and because it affects them too, as fellow-citizens. When people recognise the rights of others to have a voice and involve them, then this, in my mind, is *morally* superior to children being 'in-charge' (Hart 2008: 24; original emphasis)

A key assumption in Hart's assertion here is the capacity for participatory collaboration to be instigated by either adults or children and young people. The implication therefore is that participation is not solely a process that powerful adults enable powerless children to become involved with, but that participatory working can potentially be initiated by any individual regardless of age. Despite this positive view of participation and the possibilities it reflects, critics – including Herbots and Put (2015) – have questioned the suitability of the ladder metaphor due to the presumption of hierarchy that it undoubtedly evokes, with higher stages instantly assumed to be more important or successful than lower ones. Hart (2008) himself has recognised this limitation, although he insists that the 'upper' rungs of the ladder need not always be necessary for participatory processes to be regarded

as successful or appropriate. Unfortunately, his clarification has been overshadowed by the powerful imagery of the original ladder idea – getting to the top of the ladder is usually the goal – and consequently assumptions of the top rung being the 'best' remain.

These debates over types of participation in childhood studies were rightly motivated by attempts to move away from the concept of passive children and young people, but this focus may have contributed to the impression that participation is now the best (and perhaps only) way to engage. Despite the desire to avoid a hierarchy of engagement (Science for All 2010), there is a danger that the field of public engagement with science is finding itself in this same predicament. Based on the Hartian assertion that in-depth participatory processes should not be an unquestionable aim, adults seeking to engage young people (whether in public engagement with science or childhood studies) should initially reflect on the purpose of their engagement, rather than blindly insisting on a form of participation from the outset. Furthermore, this judgement may need to be flexible and potentially change during the course of the engagement.

In an attempt to shift attention away from participation as a goal, Herbots and Put (2015: 167) – influenced by previous important frameworks (such as Hart 1992, Shier 2001) – instead propose a "participatory disc" with four domains of similar importance: purpose, context, stakeholders, and mode. These domains could alternatively be represented by the questions: why, where, who, and what (Herbots and Put 2015). Although their use of this participatory disc to analyse the UNCRC articles would have benefitted from exploring some practical examples, the potential for this disc in practice appears more appropriate than the drive for participation currently prevalent in both childhood studies and public engagement with science. Since the notion of participation now has much greater recognition than before the parallel revolutions of both public engagement with science (e.g. Wynne 1995) and childhood studies (e.g. Prout and James 1997), attention needs to move away from participation as an overriding theoretical aim, and instead focus

given to the purpose of particular exercises. This focus on why an exercise is needed will guide which mode of engagement – communication, consultation, or participation – is most appropriate and better enable the achievement of successful outcomes.

The focus on the project's purpose – and consequential decisions on the mode of engagement – is important within this current thesis. The driving motivation in this literature review so far has been a focus on young people and raising questions around their perspectives on the different modes of public engagement with science. However, exploring this topic with young people reflects an identical cyclical issue: how should young people be engaged in order to explore their science-engagement preferences? Decisions regarding this engagement required my reflection on the project's purpose and also relied upon concepts of agency, expertise, and diversity that would be brought to bear in this project's design. Therefore, it is to these ideas that this review now turns.

2.3 The interplay of agency, expertise and diversity

This section explores the valuable concepts of agency, expertise and diversity, with particular attention on how these concepts can promote or prevent engagement opportunities for children and young people. Initially, the section outlines the foundation for contemporary debates on childhood agency and highlights a need to look again at this concept. Then, it moves to examine key examples that illuminate how expertise can be permitted as a positive contributor and conversely how it can also be excluded. This is followed by elucidating the significance of pluralising significant terms such as 'publics' and 'childhoods', in order to highlight the diversity inherent in each.

2.3.1 Childhood agency: a right or opportunities for choice?

The concept of agency is fundamental to acts of participation and conflicts with ideas of deficit models discussed in section 2.1.1. Based on a socio-cultural

perspective, where people affect – and are affected by – other people and objects around them, agency has been defined as:

> …a dynamic process that is constructed in interaction with a cultural context: it is via social interaction and dialogue that agency is constructed, contested, negotiated and renegotiated. (Kumpulainen *et al.* 2014: 213)

Thus, agency is not an attribute that an individual possesses, but is realised through interactions with others based on exchanges between knowledgeable individuals (Gallacher and Gallagher 2008). Within childhood studies, it is claimed that childhood agency remains one of the most dominant focuses of interest, being described by some as "…an obvious and omnipresent element of Childhood Studies" (Esser *et al.* 2016: 17). For many commentators, the genesis of ideas around childhood agency and participation originated in the new sociology of childhood (Prout and James 1997) – which rejected the traditions of developmental psychology where research was conducted on children instead of with them (Woodhead and Faulkner 2000) – and the United Nations Convention on the Rights of the Child (UNCRC; United Nations 1989).

2.3.1.1 Fundamental influences: new sociology of childhood and the UNCRC

Firstly, against a background of political movements (Prout and James 1997) and theoretical developments (Prout 2011), the new sociology of childhood emerged, for which Prout and James (1997) articulate the following foundation:

- Childhood is a structure affected by local context (i.e. culture / time);
- Childhood is not alone as a structure and is affected by other variables: there is no one single childhood;
- Childhood sociology, independent of adults' perspectives, is worthwhile;
- Children are active agents;
- Ethnography is a useful related methodology (see Mayall 2000); and
- A change in childhood sociology reflects a change of childhood in society.

The new sociology of childhood (although perhaps not so 'new' anymore, see Tisdall and Punch 2012) has been highly influential, outlining a more respectful foundation for research with children and young people (Prout and James 1997). However, each of the tenets have affected the field of childhood studies to varying degrees: with arguably the most pervasive outcomes being the recognition of young people's agency and the increased value of their participation. For public engagement with science, this relatively recent recognition of young people's agency (including freedom of choice), expands debates around the governance of science and the incorporation of complementary perspectives to improve decision-making (Harmon *et al.* 2013, Pallett and Chilvers 2013, Sturgis 2014) by adding the idea of young people's perspectives, which has so far been absent.

Secondly, the United Nations Convention on the Rights of the Child (UNCRC; United Nations 1989) encourages that children and young people should have their views heard on issues that impact their lives at an appropriate level in keeping with their age and capabilities, thus highlighting the perception of a competent child instead of an incompetent one (Reynaert *et al.* 2009) who is capable of using their knowledge and skills in relevant situations (Tisdall 2018). Therefore, the UNCRC has been a positive influence, being described as "...a leading international instrument for promoting children's rights," (Tisdall and Punch 2012: 259), while also being given the same level of importance as civil rights struggles (Pupavac 2001: 96). It is recognised as "...the most ratified international convention" (Tisdall and Punch 2012) with currently the United States being the only UN nation yet to fully ratify the agreement after Somalia and South Sudan both ratified the convention in 2015 (United Nations Human Rights: Office of the High Commissioner 2019). Although this suggests overwhelming international commitment, it needs to be acknowledged that this widespread adoption may be partly due to the apparent lack of enforcement procedures around the enactment of the convention (Tisdall and Punch 2012).

Additionally, some writers question whether the UNCRC adequately reflects the views of childhood that are central to its influence. Observers state that the convention did not seek the participation of young people in its development (UNICEF 2005, Tisdall and Punch 2012), and therefore only captures the perspective of adults in its core intentions. Furthermore, although some local commentators (e.g. Rwezaura 1998) regard the UNCRC as an opportunity for the progression of children's rights, the relevance and application of the UNCRC to the Majority World has also been criticised, mainly due to the domination of Minority World countries in its development (Tisdall and Punch 2012). The irony of such an influential instrument for children's rights debates worldwide not involving any children across the planet in its production is a striking one in hindsight: select adults decided on the rights of others on their behalf.

In spite of these limitations, the UNCRC has undoubtedly been critical to the reconceptualisation of childhood studies, particularly in the Minority World, and remains an important justification for many researchers in their approaches. This is reflected by its numerous citations in childhood research throughout this century (for a few examples, see Alderson 2001, Shier 2001, Cairns 2006, Burton *et al.* 2010, Lundy and McEvoy 2012, Smit 2013, Herbots and Put 2015, Kim 2016, Cuevas-Parra and Tisdall 2019). For many scholars, attention is predominantly focused on three key articles: to protect the right of the child to state their views and for these to be listened to (article 12); to advance the right to the freedom of expression in any format (article 13); and the emphasis on society – especially on parents and close family – to support the child in exercising their rights (article 5). Through these specific articles, the UNCRC captures the contemporary view of childhood; justifies the rationale for listening to young people; and promotes greater engagement with children and young people (Lundy and McEvoy 2012: 130). Additionally, these three key UNCRC articles reflect the essence of the third and fourth statements within the new sociology of childhood: childhood sociology is worthwhile in itself and not just as a counter to adult perspectives, and a recognition that children and young people are themselves active agents. Consequently, these prominent contributions to

contemporary childhood studies have together underpinned the expansion of participatory research involving children and young people, resulting in several organisations (such as Save the Children and Barnardo's) developing toolkits and training programmes to expand the knowledge base beyond those in the immediate area of childhood-sociology research.

2.3.1.2 Implications for childhood agency

Nonetheless, recently questions have been building around depictions of childhood agency. Some authors have queried that if adults suggest that children are experts in their own lives and can exercise agency, whether these same adults should be developing research tools that explicitly seek to empower children and young people (Gallacher and Gallagher 2008). If they are already active agents, empowerment is a conflicting notion, unless there is an underlying assumption that children and young people only have agency within specific parameters, and being involved in adult-instigated research is outwith these parameters. Building upon this critique, Esser *et al.* (2016) draw attention to the idea of an unquestioned assumption of childhood agency without any regard for the actual context in which it is situated. Thus, as Kumpulainen *et al.* (2014) argue, there is a risk that agency has been overly discussed as an abstract concept without due reflection on how this is enacted within real-life conditions. Therefore, based upon this lack of attention on agency in context, the combination of the fundamental foundations of childhood agency from the basis of choice ('new' sociology of childhood) and rights (UNCRC) pose a challenging tension for adults involved in public engagement with science. Specifically, these challenges surround the extent to which freedom to choose should be incorporated within exercises, especially with a view to the exercise's purpose. There is also a question of how the presented option(s) will be perceived and reacted upon by the young people involved. Significantly, for those developing public engagement with science exercises, these tensions demand reflection on how the expertise of different and diverse groupings are able to contribute to the engagement objectives of specific projects.

2.3.2 Expertise: the recognition of contributions from multiple sources

Contemporary debates around public engagement with science advocate for an expansion of expertise recognition beyond solely the scientific. This involves not only contextualising science by exploring how it intertwines with the rest of society, but also to embrace the heterogeneous concept of 'publics' as opposed to the homogeneous alternative of 'public' (Jasanoff 2014). From a childhood studies perspective, Nolas (2015) argues not only that publics as a plural term recognises the diversity within what was previously singularly called the 'public sphere', but also that publics are not fixed entities, but emerge from a basis of commonalities (e.g. interests, issues, identities). Therefore, children and young people are also included within any construction of publics.

Recombining expertise from science and society conflicts with previous efforts to emphasise the distinct nature of the scientific process as a predominant source of knowledge (see Gieryn 1983). However, these previous arguments were made on the basis that scientists were non-biased investigators of objective truth (Yearley 2005b), a conception which obscures the implementation of scientific research within wider societal dynamics. Reflecting on the context of the exercise clarifies the contributory role of science, as well as assisting choices on how to engage, consequently avoiding assumptions that one mode of engagement (e.g. participation) is better than others (Irwin 2008). This suggested framework opens up the capability to view expertise as contingent and subject to the precise area of concern: the expertise of different parties can be negotiated and prioritised at different times, which relates to the agency of those involved and therefore the power relations at play.

Returning to the idea of different engagement modes, there is a clear shift towards recognising expertise from alternative perspectives as the mode moves from communication through consultation and then participation. Evans and Plows (2007) present a useful conceptualisation of expertise, which eschews a simplistic scientist-public foundation, but instead has two distinct elements: the level of

expertise and the type of expertise. Firstly, the level of expertise is described as a continuum with the following stages: beer-mat knowledge; popular understanding; primary source knowledge; interactional expertise; and contributory expertise. Secondly, the types of expertise are either universal (i.e. the knowledge is widely-known throughout society) or local (i.e. specific topics due to geographical or experiential factors). This shift in terminology recognises the importance of other expertise beyond scientific, incorporates relevant experience, and allows an improved opportunity to involve other domains (e.g. social, economic, etc.) (Evans and Plows 2007). The key factor in developing specialist expertise (Collins and Evans 2007a) and judging the expertise of others (Collins and Evans 2007b) appears to be practical experience: through direct experience of a particular domain, it is possible to develop contributory expertise within that domain. These arguments integrate well with contemporary childhood studies, where even young children are argued to be experts in their own lives (Clark and Statham 2005).

However, this continuum of expertise has its limits. It is argued to be anti-democratic, since it restricts opportunities for 'non-experts' to participate only to the implementation of scientific knowledge and not to the development of the technical knowledge itself (for a detailed analysis of the debates, see Durant 2011). As a counterpoint, some suggest that interactional experts, when their perspectives are taken seriously, can deliver insights through their local knowledges or by challenging baseline assumptions (Plaisance and Kennedy 2014). This perspective aligns with Goddiksen (2014), who argues that imitating the language of contributory experts (seen as important by Collins and Evans) is a restrictive definition of interactional expertise, particularly when considering interdisciplinary projects which benefit from different perspectives from different domains. Key to these arguments is a sense of permission and how this is granted, or established, within an interaction and under what circumstances.

Therefore, the utilisation of participatory engagement that appropriately recognises the contributory expertise of others regarded as complementary, necessarily

encourages a sharing of power between all those involved. This can be illustrated by returning to the example of the scientists in Cumbria dealing with the environmental impact of the Chernobyl nuclear emissions (Wynne 1992a) and exploring this further through the continuum of expertise suggested by Evans and Plows (2007). From the description Wynne provides, scientific expertise in dealing with the crisis is prioritised, leading to decisions based solely on the singular perspective of science ignoring other views – there is no recognition of the interactional expertise resulting from local knowledges. For example, moving livestock caused immediate practical issues for the farmers, as well as raised the potential of feed issues in future years (Wynne 1992a). The arrogant approach of the scientists in their decision-making, influenced by a political will to reduce the potential for panic amongst the populace through comforting reassurances (now shown to be misplaced), did not appropriately address the practical issues of contaminated livestock and led to damaged relationships with local communities (Collins and Pinch 2014), who felt undermined and stripped of their autonomy. It was the farmers who first considered the possibility that the 1957 Sellafield fire fall-out contributed to the prolonged high radiation readings that were being recorded; the scientists at first dismissed this view, but later accepted this after revising their conceptual model (Collins and Pinch 2014). Therefore, rather than the dualistic approach of holding one source of expertise over the other, the incorporation of local expertise in dealing with the situation (i.e. a participative approach) may have improved the outcomes with regards to the impact on the farming community.

Along a similar theme, the impressive account of US AIDS activists engaging with the medical process in the 1980s demonstrates the potential benefits of combining contrasting areas of expertise: “One of the most striking aspects of the conduct of AIDS research in the United States is the diversity of the players who have participated in the construction of credible knowledge” (Epstein 1995: 408). Activists secured their participation and the inclusion of values, other than pure science methodology, into the ongoing research debate and successfully supported the stance of community doctors, who desired a pragmatic approach (i.e. “messy”

real-life conditions), over that of clinical researchers, who prioritised randomised, controlled trials (Epstein 1995). This included the choice of patients to accept the risks of experimental treatments (Epstein 1995), which was mirrored during the Ebola outbreak in 2014-16 (U.S. Department of Health and Human Services 2014), with the World Health Organisation accepting the use of experimental treatments was ethically more acceptable than the usual (more long-term) clinical-trials process (World Health Organisation 2014). The AIDS research activists were ultimately successful in their negotiations with the medical representatives regarding their contributory expertise. However, this required significant effort and struggle on behalf of a core group of activists – including learning technical medical language – in order to be regarded as having suitable expertise to contribute.

The struggle of the US AIDS activists described by Epstein (1995) appears to be focused not only on the level of expertise itself, but also on whether the expertise domain is judged to be relevant to the specific engagement by others involved in the exercise. Where the AIDS activists were successful – partly due to their actions to circumvent the clinical trials process by sharing trial drugs across cohorts, including the control group who were not meant to receive the drug – the Cumbrian farmers were not. This focus on expertise domains can be extended to public engagement with science processes involving young people and again raises a question of how their expertise can be given the opportunity to genuinely contribute. However, there is also an issue surrounding whether any opportunities to contribute expertise are welcomed by young people who would need to see themselves as active contributors, or whether there are particular conditions within which this level of engagement is of (greater) interest.

2.3.3 Recognising diversity in publics and childhoods – the importance of pluralisation

While I take an intergenerational focus in this thesis, aligning with others such as Mayall (2012), Wyness (2013) and Punch (2019), this approach does not assume

that all childhoods are the same. Thus, the exploration of young people's perspectives on public engagement with science needs to remain pluralistic, embracing diversity and not regressing to a homogeneous singular 'voice'.

It is argued that modern childhoods are marked by young people only interacting with specific adults (e.g. parents and teachers) and they therefore have a limited impact on society (Qvortrup 2005). This is very much a Minority World perspective. By way of contrast, other writers outline numerous perceptions of children and childhoods within various global contexts, including: children as equals; children as an economic investment; and children as unwanted or non-human (see Montgomery 2009). However, the differences of childhoods are not only highlighted by the Minority/Majority World comparison that Montgomery (2009) employs. For example, it is inaccurate to suggest that all children and young people in Minority World countries experience the same level of protection from – and denial of – the roles and responsibilities that are 'usually' the domain of adults (cf. Pupavac 2001). Additionally, socio-economic factors – such as access to healthcare, crime rates, employment rates, etc. – also differ within nations, which in Scotland is illustrated by the Scottish Index of Multiple Deprivation (Scottish Government 2020). Therefore, it should be readily seen that making assumptions concerning the childhoods that exist within any particular location should be avoided. Furthermore, while young people in the Minority World may not be perceived as marginalised from a global perspective, they may be in relation to their local contexts.

2.3.3.1 The biosocial-nexus lens: a limited tool for recognising complexity and diversity

As a consequence, recognising diversity also requires a recognition of the complexity of modern life. Although the positive impact of the new sociology of childhood (Prout and James 1997) in encouraging academic attention to childhoods and related practice is widely recognised, there are now calls to explore how perspectives have changed since it was originally proposed (Tisdall and Punch 2012). In particular, scholars are beginning to question whether the agency-

structure dualism at the heart of the new sociology of childhood adequately captures the intricacies of reality. For example, Lee and Motzkau (2011) build on Prout's (2005) calls for a hybrid concept of childhood, arguing for an intertwining of the biological and social rather than regarding each independently. Going further, Ryan (2012: 440) proposes there is now a "new wave" of childhood sociology which is founded upon the "biosocial nexus": an inseparable interlinking of the natural and social.

As the basis for their argument, Lee and Motzkau (2011) use the debate surrounding the Mosquito Teen Deterrent[21] device – which emits high-pitched sounds that are only uncomfortable for younger people due to biological ageing – to show how the biosocial combinations within their three dimensions (called 'multiplicities') of life, resource, and voice can be utilised:

- 'Life' brings together the biological processes of development with legal and ethical rules and expectations for living;
- 'Resource' relates to political choices on the role of children in society, as well as aspects of identity (e.g. gender, ethnicity, abilities); and
- 'Voice' is concerned with participation and the contexts in which a child's voice can contribute particularly as they mature.

However, although these dimensions each incorporate a biosocial perspective, the questions around the Mosquito device that the authors propose, such as how childhood autonomy can be affected by social and geographical dimensions, are not unique to their hybrid approach – as Lee and Motzkau (2011: 17) admit. Consequently, the idea of a biosocial nexus seems limited as a practical tool, which Ryan (2012: 449) also concedes: "threads" can be taken from the complex biological and social network of concepts, despite being claimed to be an "irreducible whole".

[21] The device works by exploiting the age-related hearing loss of high-frequency sounds. It is claimed that only young people, perhaps up to 25-years old, are able to hear the loud, high-pitched noise and are therefore irritated by it to such an extent that they cannot remain in the vicinity of the device for long. Older people are likely to have lost the ability to hear such high-pitched sounds – regardless of its volume – and they are so unaffected by the device, they do not realise there is any noise at all.

In fact, the questions developed by Lee and Motzkau (2011) through their multiplicities seem principally to relate to societal concepts of autonomy, agency, participation, and power relations: aspects of the biosocial dualism they seek to supersede. Therefore, despite more recent proposals, the foundation of Prout and James (1997) – in combination with the UNCRC – still offers an important basis for research involving children and young people through explicitly recognising and promoting their agential potential.

2.3.3.2 Diversity of childhood and impacts on public engagement with science

The recognition of young people's perspectives contributes to reflections on the suitability of public engagement with science exercises. Some small-scale exploration of public views on public engagement with science exercises has already taken place, which highlights public support for all three engagement modes (Jensen and Buckley 2014), with desires for varying degrees of involvement depending on personal preferences (Wilkinson *et al.* 2012). Within one such study, Wilkinson *et al.* (2012) attention to robotics-themed engagement events in the UK suggests that most publics desire an active involvement in communicative engagement modes (e.g. interactive exhibits in a science museum; question and answer session following a presentation), rather than just a passive acceptance of what scientists say.

In a second example, the majority of the UK's GM Nation? public debate participants (77%), responding through a survey, endorsed the idea of the further use of public debate exercises related to innovations in STEM (Poortinga and Pidgeon 2004). However, survey approaches do not enable the precise reasons for these conclusions to be fully articulated, since – as Harvey (2009) asserts – a quantitative-based evaluation loses the specific experience of an individual event. Therefore, the influential factors within the GM Nation? process – e.g. facilitator actions, opportunities for dialogue, backgrounds of those involved – are not

explicitly foregrounded by the evaluation, and consequently the reasons for the apparent positivity cannot be explored.

Thus, when it comes to the views of young people on public engagement with science, these previous studies highlight the opportunity to use small-scale participative projects that enable young people's insights to be revealed in more organic (and less restrictive) ways. Furthermore, there is an argument to also include other social orders within these explorations: childhoods are affected by concepts of gender, race, disability, sexuality, class, and geography just like adulthoods (Konstantoni and Emejulu 2017). These concepts have made variable impacts in our understandings of the social world, with the gender order arguably gaining most attention (Punch 2016, 2019). In comparison, the generational order has had little impact beyond the field of childhood studies (Punch 2019), despite Minority World societies being greatly separated by age-based judgements and choices ("age-segregated" according to Vanderbeck 2007) and being a permanent fixture in these societies (Qvortrop 2009). Adult agendas, for example, are said to significantly impact young people's participatory opportunities (Wyness 2009). Therefore, for public engagement with science where little attention has been given to young people's perspectives, this thesis responds to the call of Punch (2019, see also Mayall 2012) in considering the implications of the generational order beyond the field of childhood studies, by exploring young people's preferences within public engagement and how they may be meaningfully involved and contribute in different ways.

2.3.4 Discussion

Despite initial explorations of public perceptions, there remain significant gaps in how different publics perceive the full range of public engagement with science processes. For example, as Jensen and Buckley (2014: 558) suggest:

> ...there is a relative paucity of rigorous empirical and conceptual scholarship addressing how informal (i.e. non-policy linked) public

> engagement events like science festivals, or 'communication'-oriented engagement activities more generally, are viewed by publics.

Although some attention is now being given to this identified concern – such as a three-year survey of public views of an annual New Zealand science festival (Fogg-Rogers *et al.* 2015) – there remains strong academic interest (e.g. Jasanoff 2014, Stilgoe *et al.* 2014) in exploring what publics seek from their involvement across various public engagement with science exercises, not solely the communication mode.

In particular, the specific perspectives of young people with regards to public engagement with science is missing from our current knowledge (as examples of this absence, see Wynne 1992a, Wynne 1995, Bucchi and Neresini 2007, Jasanoff 2014). Within public engagement with science debates, overlooking children and young people suggests a lack of recognition of childhood agency and a denial of the expertise (through their skills and experiences) that they could contribute. Furthermore, the minimal exploration of engagement preferences has been focused on particular examples or contexts, such as museums (Mujtaba *et al.* 2018); science festivals (Jensen and Buckley 2014, Kennedy *et al.* 2018); and science on TV (Dhingra 2006). However, more recent studies have begun to explore how some experiences – like science festivals and museums – have minimal appeal to certain publics defined by socio-economic and/or ethnic statuses (Dawson 2018, Kennedy *et al.* 2018). Furthermore, DeWitt and Archer (2017) have explored the variety of experiences across a broad selection of young people, but with no explicit attention on the combination of these experiences nor the drivers for them (see also Archer *et al.* 2018).

This lack of in-depth attention on the preferences of young people with respect to their science experiences and how they could meaningfully contribute to them forms the foundation for the present study. For example, given the substantial encouragement for the participation mode of public engagement with science, it would be informative to explore whether young people regard this mode as

positively as policymakers do within their ranges of experience, especially with a view on whether the suggested benefits are realised, both in terms of the exercise and for the young people themselves. The need for research extends to how young people wish to be engaged more generally, which combines with how they view themselves within science engagement, as well as how engagement initiators perceive them and their potential for involvement, based on notions of agency and expertise. Therefore, a research approach that enabled the incorporation of perspectives from young people was vital for my own research, and therefore attention was needed on how I, as an adult, would interact with them and the dynamics that would result. Thus, the next section reflects on insights from intergenerational research approaches.

2.4 Shining a light on the role of power in intergenerational research contexts

As I argued in section 2.2, in support of others (e.g. Tisdall *et al.* 2008, Nolas 2015), those initiating engagement exercises need not overly focus on the degree of participation that young people should have as part of the activities, but rather on the exercise's purpose. This is not to claim that previous suggestions for how participation can be positively developed within a process should be overlooked, but merely that this need not be the main overriding objective of the process. In a manner fitting with the participatory disc that Herbots and Put (2015) suggest, an initial judgement is required on research purpose and subsequently the degree of young people's involvement in order to achieve a suitable level of exploration of their perspectives. This foundation provides the basis for my study, and also brings in notions of intergenerationality and the consequent power dynamics which I explore in this section. My aim here contrasts with the early days of the new sociology of childhood (Prout and James 1997), where there was a great emphasis on the process of participation itself (see Nolas 2015), which – based on arguably hierarchical perceptions of participatory models (Hart 1992, Shier 2001) –

overlooked the project's purpose and instead instigated a drive for projects where children or young people initiated and took the lead.

2.4.1 Child-led research: a provocative notion

The notion of how leadership is enacted in practice overlaps with contentious debates around 'child-led' research. Participation is the foundation of child-led research, in which children and young people are involved extensively across different stages of the research process, supported (rather than managed) by adult facilitators (Kellett 2005), which enables them to be directly connected with adult decision-makers resulting in positive change (Cuevas-Parra and Tisdall 2019). Based on Cuevas-Parra and Tisdall's (2019) summary, leading voices in childhood studies have suggested that child-led research is either: research that needs to be judged differently to adult-led research; not research, but a more basic form of inquiry with less-stringent restrictions; or a form of research if research is not limited by notions of validity, reliability, rigour, etc. The broad definition, and consequent broad understanding, of what child-led research entails, provides significant scope for researchers to claim they have facilitated this form of research. Within formal research endeavours, the facilitating – rather than managing – role of supportive adults is a critical aspect, which raises questions for the power relationships within any given project.

In one example of child-led research (Kellett *et al.* 2004), there are two aspects which erode confidence about claims for the 'child-led' nature of the exercises. For example, the final reports produced by the primary school-pupil researchers appear to have a similar formal structure, which suggests a pro-forma being issued by the adults involved. Of course, the children involved may still have led the projects: they may have selectively used some adult suggestions or they may have actually requested this further guidance, but no details are provided by Kellett *et al.* (2004). A greater issue is that the young researchers were selected by their teachers to be involved in the research: "It was decided initially to invite the participation of

children identified by their teachers as amongst the most 'able'" (Kellett *et al.* 2004: 332). This approach raises a query over the initial freedom of choice the children had and the resultant degree of participation (see Hart 1992). By not initiating and volunteering their own involvement, the children did not lead their projects from the outset.

Queries raised around project instigation can be seen through other examples. In Burton *et al.* (2010) two educational psychologists worked with classes in two primary schools on separate research projects. For one of the classes, the discussion surrounding the potential research project that the class would undertake appears to be directed by ongoing staff-based discussions regarding improving the playground: the researchers do not adequately articulate how pupils contributed to the choice of topic. The fact that the authors deem it necessary to describe the writing of suggestions on a freely available flipchart during the initial preparatory phase in the second class as there were "no possible topics at the other school" (Burton *et al.* 2010: 97), brings to question the role of pupils in deciding the project focus in the first class.

In a separate critique by Cuevas-Parra and Tisdall (2019) of two further child-led projects – one involving Bangladeshi young people and the legal implications of no birth certificates, and a second around the lives of young Syrian refugees – similar questions around setting research agendas can be seen. The Bangladeshi example evolved out of existing long-term community-based relationships with the young researchers identifying the research topic they wanted to explore, while in the Syrian equivalent, adults articulated the broad agenda with participants defining the more precise scope of their investigation. These examples also show differences in the dissemination of research outputs: adults supported the knowledge-exchange strategy developed by young people in the Bangladesh project, while the adults in the Syrian context chose not to involve the young researchers based on concerns for their safety (a decision that the young people agreed with). These examples (Kellett *et al.* 2004, Burton *et al.* 2010, Cuevas-Parra and Tisdall 2019) demonstrate

the substantial variation, even within individual articles, in what is described as child-led research.

To be clear, my criticisms are exclusively aimed at what the term 'child-led research' actually means: especially where adults instigate the project, how does this impact the possibilities for children leading the overall project? The projects outlined here demonstrate many of the benefits of participation discussed in section 2.1.3, appear worthwhile for those involved, and seek to challenge the notion of adults being central to the projects. However, instead of 'child-led', what these research projects more helpfully illustrate are the benefits of collaborative working: in all of Kellett *et al.* (2004), Burton *et al.* (2010) and Cuevas-Parra and Tisdall (2019), it is the combination of skills, perspectives, and expertise of young people *and* adults in matters of mutual interest that appear to be more important, not any claims of leadership. In addition to highlighting the variability inherent within child-led research, these studies more strongly exemplify intergenerational research approaches.

2.4.2 Intergenerationality and co-production: combining insights

The concept of intergenerationality relies on the notion of generations, with assignation to a generation based on age, with the behaviour and expectations of individuals judged against the expected norms for that generation (Alanen 2009). Considering society as generationally ordered, makes the assumption that children's lives are affected by their generational status first, ahead of also being gendered, classed, raced, etc. (Alanen 2009). Although Alanen (2019) is positive about research into notions of generations and generationing[22] outside of English-speaking circles, Punch (2019) argues that the idea of generations is assumed as fact in the UK, with gender-related theorisation and debate being far more extensive by comparison (as illustrated by the limited inclusion of generational research in

[22] Defined as the practices that produce and reinforce the categorisations of adults and children (Punch and Vanderbeck 2018).

mainstream journals). Therefore, there is a need for further exploration as to how the forces of generations and generationing present opportunities and challenges for enabling how and when children and young people contribute to different levels of society. As Mayall (2015) suggests, understanding intergenerational processes is a fundamental tool for this exploration.

Instead of a 'least-adult' role, where adults try to blend in with children (Mandell 1988, see also Spyrou 2011), others argue that a dialogue-based intergenerational relationship with children and young people is more appropriate (Punch 2016), as this does not attempt to unrealistically ignore the differences between adults and children (Christensen 2004). Through this approach, there is a fundamental necessity for all parties – adults, children, and young people – to share information and learn from the process (Wyness 2013) and continuously renegotiate their position (Mayall 2012). By doing so, a variety of contributions from all those involved is enabled (Taft 2015). An intergenerational approach to childhood research is supported by prominent authors, such as Prout (2011), who argue there is a need to move away from fixed generational notions and situate everyone as 'becomings': all are interdependent and all remain in the process of developing (see Gallacher and Gallagher 2008). Central to this idea of intergenerationality is that adults involved in the participatory process also need to regard themselves as learning from the process itself (Davis 2009), and therefore from the young people involved (Mayall 2000, Kirby *et al.* 2003, Kirby 2004).

In this way, intergenerationality mirrors the notion of co-production, which has two key interpretations (van Kerkhoff and Lebel 2015, Wyborn 2015, Muñoz-Erickson *et al.* 2017), both of which are applicable to my research. Firstly, there is the concept inspired by Jasanoff (2004) of the production and use of knowledge being across all sectors of society and culture with the result that the pursuit of science is not independent of policy or citizen concerns: they build upon each other and merge with the consequence that scientists can act politically and policymakers can affect scientific discussions (Wehrens 2014). This concept from Science and Technology

Studies argues that better understandings result from regarding the natural and social sciences as being intertwined (Jasanoff 2004).

Secondly, the term co-production also applies to the act of collaboration, where deliberative relationships aim to improve the research base (Muñoz-Erickson *et al.* 2017). This depiction chimes with Ostrom's assertion (as analysed by Alford 2014) that citizens not only consume public services (e.g. healthcare, education, etc.), but they can also participate in their development. Within both constructions of co-production, positive collaborations and generating benefits are fundamental to the process (Bovaird and Loeffler 2012). Thus, just as the world of science should not be seen as separate from the social world, the domains of adults and young people intergenerationally working together can lead to improved understandings.

Consequently, co-production (and intergenerationality through the act of collaboration) is necessarily a context-dependent notion, the operation of which relates to the specific parties involved, their motivations and their relationships. As such, there can be no perfect approach to co-production: what is regarded as positive in one scenario may not be in another (Alford 2014). Motivations to be involved in co-production processes result from perceived value for selfish (important for the individual or important others) or selfless (value for unknown others on the basis of societal, environmental, or political concerns) reasons (Bovaird and Loeffler 2012, Alford 2014). These motivations reflect those of young people who may want to (selfishly) extend their own learning or (selflessly) improve practice for others (Hill 2006). Additionally, Bovaird and Loeffler (2012) suggest that difficulties for co-production include its unpredictability leading to a loss of status and control. However, the unpredictable nature of co-production needs to be regarded as a positive: combining perspectives allow tensions to be revealed. If the process and purpose of a co-production collaboration was predictable, then there would be no need for the process to take place at all, since the outcomes and benefits would already be known and the implications obvious.

Combining perspectives may not be straightforward. There may be synergies between different perspectives, but there is also the very real possibility of contrasting ideas leading to difficult choices and necessary compromises (Alford 2014, Wyborn 2015). Where science is involved, there are specific challenges due to many holding scientific knowledge in greater esteem than other forms of knowledge (van Kerkhoff and Lebel 2015). Therefore, power dynamics are at play within any notion of co-production. Although equal relationships should be sought between all participants (Bovaird and Loeffler 2012), achieving equality is a challenging goal, even if there is an agreement between all parties on what equal relationships actually look like.

2.4.3 Intergenerationality: paying attention to power dynamics

> [Power should not] be taken to be a phenomenon of one individual's consolidated and homogeneous domination over others, or that of one group or class over others. […Instead:] Power must [be] analysed as something which circulates, or rather as something which only functions in the form of a chain. It is never localised here or there, never in anybody's hands, never appropriated as a commodity or piece of wealth. Power is employed and exercised through a net-like organisation. And not only do individuals circulate between its threads; they are always in the position of simultaneously undergoing and exercising this power. […] In other words, individuals are the vehicles of power, not its points of application. (Foucault 1980: 98)

Foucault's concerted efforts to explore the notion of power have significantly impacted childhood studies, with many authors drawing upon his articulations either directly (e.g. O'Brien and Moules 2007, Gallagher 2008, Holland *et al.* 2010, McGarry 2016) or indirectly (e.g. Mayall 2000, Christensen 2004, Smit 2013, Bradbury-Jones and Taylor 2015). Foucault's (1980) argument starts by critiquing the notion that power is an entity, a thing, that can be given or taken (Smit 2013, McGarry 2016). When so depicted, power is a negative concept: it is employed by the powerful to restrain, limit, and oppress the powerless (Hill *et al.* 2004). Instead, Foucault (1980) paints an image of power being infused through the actions and reactions of people, all people, rather than being focused in specific pockets of

society. It is therefore not only about social control, but also resistance, with power being seen in small actions as well as through larger ones (Gallagher 2008). This conceptualisation draws focus away from the idea of *who* has power, but *how* power operates within and throughout society through specific relationships and interactions (see Christensen 2004, Hill *et al.* 2004).

This Foucauldian explication of power offers much to research involving children and young people, including my research. Rather than powerful adults researching powerless children and young people (Prout and James 1997, Woodhead 2008), the fluid foundation of power enables participative research encounters where power is exchanged between adult researchers and young research participants at different scales (Gallagher 2008). For example, Christensen (2004) reflects on an earlier research experience in a primary school where her participants would grab the tape recorder and ask questions, sometimes before the interview had formally begun. If Christensen had used power in a negative sense (Hill *et al.* 2004), she would have stopped her participants and re-asserted her dominance by insisting on asking her questions. Instead, she worked with power in a more fluid manner and used the children's actions as part of the interview process to develop positive relationships.

Within Minority World contexts, adults are generally in more powerful positions (Vanderbeck 2007), and therefore the onus is on them to ensure power is shared within intergenerational participation (as one example, see Cahill 2007). This view regarding adults poses a challenge for them to consistently operate Foucault's (1980) fluid notion of power. Furthermore, this view of powerful adults has arguably contributed to misplaced efforts, which have been discussed earlier in this chapter (section 2.3.1.2), to empower children and young people through designing bespoke research approaches. Although they were running a participatory research project with children, O'Brien and Moules (2007: 398) describe being "stunned" when child researchers were more effective than themselves in obtaining other children's views through interviews. This impression suggests the adult researchers' retained and forefronted some views on the limitations of the child researchers

they sought to work with. Furthermore, Åkerström and Brunnberg (2013: 529) in their study with young people as research partners state that "adult-child relations are vertical". Consequently, the foundation for adults in both projects was the assumption that they were more capable, and thus had greater power, than their young collaborators. However, for intergenerational collaboration, adults ought to be flexible in their expectations (see Kirby *et al.* 2003), suspend their normative expectations of being the powerful adult, and not regard their role as empowering young people by transferring power to them (Gallagher 2008).

The normative view of powerful adults also impacts on young participants. Some authors have argued that despite best efforts, children and young people usually believe that adults remain in a position of power despite any assurances to the contrary (Mayall 2000), due to adults' privileged status in society (Spyrou 2011). A group-based approach can help to dilute power effects and enable young people to feel more confident and empowered (Mayall 2000), but as the young councillors interviewed by Matthews and Limb (2003) signal, the group approach does not immediately resolve issues of power: there needs to be a continuous commitment from adults to value the contributions of the young participants.

The consideration of power relationships is not restricted to reflecting on adult-child interactions, there is also the need to pay attention to intragenerational power dynamics within participatory research (Spyrou 2011), which could be influenced by other social orders, such as race, gender, ethnicity, etc. (Konstantoni and Emejulu 2017). Drawing on focus-group literature, a group-based context can potentially facilitate engagement with those reluctant to engage individually, and ideas from others can spark new thoughts to contribute, but there is also the risk that views alternate to the group consensus may be marginalised (Kitzinger 1994, Kitzinger 1995). Knowing other participants in advance could encourage involvement of others (Hopkins 2007), but a dominant participant may influence the responses and other contributions of children and young people in focus groups through peer and conformity pressures (Watts and Ebbutt 1987, Gibson 2012). For example, Watts

and Ebbutt (1987) argue that negative comments can lead to a spiral of further negative comments, while Lezaun (2007) argues that a dominant influence may sway others too easily. Therefore, in a focus-group context, the onus is on the facilitator to draw out opinions from all (Lezaun 2007) and enable those not actively participating to become involved again (Gibson 2007).

Bringing the focus back to intergenerational projects, there is much to consider. Normative expectations of adults working with children implies that the power dynamics may easily replicate those of focus groups where the (adult) facilitator maintains a view of how participants are interacting, an approach which comfortably aligns with traditional research where adult researchers are leading. However, for participatory approaches – e.g. "child-initiated, shared decisions with adults" (Hart 1992) – there is added complexity resulting from an awareness of intragenerational relationships from an intergenerational standpoint: the sharing of responsibility between all participants (including adult researchers) could be in tension with the normative adult-child working expectations.

2.4.4 Ownership within intergenerationality: an overlooked resource?

When analysing how power is exchanged and utilised within intergenerational collaboration, the concept of project ownership has had little attention beyond that of Franks' (2011) reflection into levels of participation (i.e. how participants can own parts of a wider research project). What is missing is a focus on how ownership is actually felt by participants and how this impacts on their project involvement. The notion of ownership can be applied in contrasting ways, including for the purpose of empowerment (Luechauer and Shulman 1993, Handberg 2018), which presents conceptual challenges for intergenerational collaboration as I have previously explored. More positively, when linked to participation, ownership is argued to improve the outcomes of specific processes through instigating greater support and investment by those involved (Handberg 2018).

In their exploration of natural resource management, Lachapelle and McCool (2005) suggest that ownership is only concerned with who is involved and who has influence on a project or process (see also Lachapelle 2008), but they ignore the emotive aspects that makes ownership more personal (Wiley 2009), such as the role of individual responsibility (Manning and Ginger 2007). Furthermore, with their argument that ownership "…acknowledge[s] alternate forms of knowledge and allows for more inclusive distribution of power over outcomes," Lachapelle and McCool's (2005: 282-3) definition has greater application to how successful a collaboration is (or can be) rather than any sense of ownership that participants experience (see also Manning and Ginger 2007). As a more suitable alternative, ownership is argued to denote having control or responsibility, being personally committed, or having an affinity or pride in something (Wiley 2009); concepts that Hanauer *et al.* (2012) have applied to project ownership. This view of ownership embraces not only who is involved, but rightly recognises the personal drive and responsibility that a sense of ownership inspires.

Regarding children and young people, within a school context, Robinson (1994) equates ownership in a classroom with pupil choice of what happens within the space. By providing possibilities for children to choose – including what goes on walls and how tables/chairs are positioned – Robinson (1994) argues that pupils develop a sense of ownership over their classroom. Employing Wiley's (2009) framework for this example, it is obvious that pupils had greater responsibility, and they may also have gained more pride in their space. This interpretation is strengthened by Killeen *et al.'s* (2003) study on pupils who produced permanent artworks for their school and consequently experienced a greater feeling of ownership.

On a related note, it has been argued that the more input an individual has, the greater their sense of ownership will be (Nail 2007). However, the notion of input is quite subjective, which may endanger the actual sense of ownership that individuals develop. For example, in Nail's (2007) advice for teachers on co-producing

newsletters with their pupils, she suggests that teachers should produce newsletter templates and contribute their own articles. Without involving pupils in these decisions, the teacher could be taking away opportunities for inputs, thus reducing opportunities for their pupils to develop a sense of ownership over the newsletter. However, this risk may be tempered by the idea that a sense of ownership could relate to any stage of a project – the conception, the process, the implementation – and not just the entire project (Handberg 2018). Consequently, as with assessments around levels of input towards a project's goals, the idea of ownership itself is personal and subjective, yet requires further exploration in how it applies within intergenerational projects. Therefore, this thesis particularly focuses on the gap in knowledge around Hanauer *et al.'s* (2012) application of Wiley's (2009) concepts of ownership and whether this conceptualisation requires revision for intergenerational contexts.

2.4.5 Discussion

Intergenerationality has formed the basis of much contemporary attention on the notion of participation as it relates to research with young people (e.g. Mayall 2012, Wyness 2013, Punch 2016). Specifically, the focus has turned to illustrate the benefits and limitations of participatory approaches and highlighted intergenerational mechanisms as being an appropriate route for research projects involving adult agendas that recognise the agency of children and young people (Punch 2016). This basis raised questions about structures for intergenerational working appropriate for my research, particularly in terms of power dynamics (Foucault 1980, Gallagher 2008) and the sense of ownership that participants feel (Wiley 2009).

One such structure is the advisory group, which seeks to utilise the agential choices of young people within a process that foregrounds the perspectives of young participants (e.g. Matthews and Limb 2003, Roholt and Mueller 2013). This approach seeks to enable exploration starting from where young people are, rather

than originating from the views of the researcher. Youth programmes are a further structure; these have a wide foundation from those that are principally adult-driven through to those that are primarily child-driven, where adults support the choices of the young participants rather than direct them (Larson *et al.* 2005b). With these structures foregrounded, the next section of this review focuses on the idea of a young person advisory group which formed the heart of my research.

2.5 Young person advisory groups and youth programmes: embracing intergenerationality

The advisory group in this study aimed to prominently incorporate the voices of young people through an intergenerational approach. This reflects similar approaches within science and technology studies, where Felt and Fochler (2008) argue that publics engaging with scientists in a participative manner enables the beneficial inclusion of ethical and social perspectives into the research process. Although they do not name it as such, the inclusion of other perspectives may be seen as one rationale for an advisory group: to ensure – in the manner of Evans and Plows (2007) and Collins and Evans (2007a) – that relevant domains of expertise contribute to the overall research purpose in a constructive way. In a similar vein, young person advisory groups – sometimes known as youth councils (Matthews and Limb 2003) – are based on the premise that competent young people provide valuable perspectives and positively contribute to decisions in their communities and beyond, contrasting with youth interventions that focus only on solving the issues of young people (Richards-Schuster 2012). The advisory group approach opens up the attractive possibility to interactively explore the viewpoints of young people.

Adult engagement with youth forums can play a key role in the potential impacts of youth groups, which reflects the range of potential limits and benefits of participation outlined in section 2.1.3. As one example, Matthews and Limb (2003) reveal through their interviews with youth councillors in the UK's East Midlands,

how, on the one hand, young participants can feel negative about their involvement if they perceive that adults: dominate the agenda, restrict funding decisions, overwhelm young participants in meetings, and ignore the voices and recommendations of the youth council. On the other hand, adults' perceptions of the youth council can aid their legitimacy, and adults themselves can provide realistic expectations for young councillors, and share control with young people (Matthews and Limb 2003). The views of these East Midlands youth councillors demonstrate the vital role of the intergenerational relationship: if young people do not feel valued within the process by making choices that enable progression, then the potential for positive participation appears to be diminished, which will have a detrimental impact on the operation of the group. Young people have expectations of adults within formal interactions (Kirby 2004), usually placing adults in positions of authority (Vanderbeck 2007, Taft 2015), a conception that can be difficult to overcome despite assurances to the contrary (Pinter and Zandian 2015).

A further revealing example of adult engagement with young people is the Youth Council of the Ann Arbor Community Area Community Foundation in the USA (Richards-Schuster 2012). This council includes 20-25 local young people that participate in the funding decisions of programmes and structures aimed at young people: those involved should have a recognised voice in the process. Other studies have revealed examples of symbolic young people advisory groups, where voices are sought, but are not actively listened to (Roholt and Mueller 2013) resulting in the tokenistic outcomes described in the 'lower' rungs of Hart's (1992) participatory ladder. It is unclear from Richards-Schuster's (2012) description, whether the Ann Arbor example has successfully avoided potentially tokenistic outcomes. The Youth Council has two members on the board of the related (adult-based) Community Foundation, which decides on grant funding outcomes based on the work and recommendations of the Youth Council itself. However, only one of the young people on the foundation's board is able to vote – it is not revealed how many members are on the board in total – and grant requests are assessed by the Community Foundation staff before the Youth Council are even involved.

Nevertheless, this example makes it clear that successful participation is not just dependent on merely having an advisory group, nor on the participants themselves, but on the level of influence which is permitted by the individual or group (usually adults) they are there to advise.

Furthermore, the level of influence of young participants links to notions around ownership and decision-making within a project. With respect to these elements, adults' actions are argued to have a significant impact on how youth councils operate (Matthews 2001). As part of a review of several youth programmes, Larson *et al.* (2005b) describe a specific Youth Summit organised by a group of 20-25 inner-city young people, who set the project agenda and were supported by adults to achieve their goals. The subjective nature of ownership is illustrated: within the project, the adults undertook a number of tasks, such as the group administration (e.g. kept the calendar updated), transported group members, and analysed the survey data. It could be argued that having adults undertake these tasks undermines the youth-driven nature of the project, and consequently threatens the young participants' claims of ownership. However, the young participants regarded these adult actions as supportive of the goals that they had defined (Larson *et al.* 2005b) rather than being adult-imposed interventions. Therefore, the notion of ownership is not just about the responsibility for different tasks, but also feelings of personal investment that individuals have.

Summing up, the above exploration of prior research into intergenerational contexts highlights tensions related to power dynamics, such as those between the adult researchers and the young participants, as well as directly between the participants. These tensions raised important queries for my study, which demanded attention to the complex power dynamics within the advisory group setting, including a focus on the subjective nature of ownership.

2.6 Conclusion: literature review discussion and research questions

In response to Punch's (2019) call for contemporary childhood studies to impact other academic disciplines, in this chapter I have summarised pertinent literature from public engagement with science and childhood studies to highlight the gap around the perspectives of young people on all modes of public engagement with science and how young people may be meaningfully involved and contribute in different ways. Although much has been said in the respective literatures about how publics should be engaged and how children and young people can be involved in research, there is a dearth of attention at where these literatures ought to inform each other, despite significant examples of similar debates (e.g. the shift towards participatory engagement / research).

More specifically, I have argued that tensions exist in the following areas:

- the communicative mode of public engagement with science and whether young people have negative perceptions that align with views around deficit models, or alternatively whether they regard this mode positively due to opportunities for learning and inspiration;
- how young people regard the consultative mode of public engagement with science in terms of either the successful acquisition of their views or the curtailing of their genuine contributions;
- the extent to which the participation mode of public engagement with science is welcomed by young people and, if so, to what degree the positive aspects of participation are felt by young people;
- the role of young people's agency within public engagement with science exercises, based upon the notions of choice and rights, and how these are taken up by young people and concurrently present challenges for the adults involved;
- the potential for the expertise – in the forms of skills and experiences – of young people to actively contribute within public engagement with science

exercises, and whether these opportunities are desired by diverse young people;

- whether an intergenerational approach in practice, such as an advisory group, can enable the foregrounding of young people's perspectives through appropriately addressing issues of power; and
- how notions of project ownership apply to intergenerational collaborations, and, within this context, whether anything is missing from existing conceptualisations.

Consequently, this thesis is interested in addressing this set of tensions through four key research questions. The first two relate closely to public engagement with science, whereas research questions 3 and 4 contribute more to debates in childhood studies. However, these two strands should not be regarded as mutually exclusive:

Research question 1: What are the perspectives of young people with respect to public engagement with science exercises?

Research question 2: Within public engagement with science exercises, to what extent can young people be actively engaged and what possibilities exist for young people to contribute their skills and experiences?

Research question 3: What are the issues and implications of the power dynamics present within an adult-instigated intergenerational project and how can these be addressed?

Research question 4: Within an adult-instigated participatory research project, how do young people demonstrate their agency and how do they re-mould the project as it progresses?

The next chapter outlines the methodological decisions that were made in order to investigate and respond to my key research questions. A case study research

approach was chosen in order to adequately capture the complexity of the questions posed and enable a suitably flexible dynamic.

3 Methodology: a co-production practitioner case study

In this chapter, I reflect on and justify the methodological decisions I made based on a pragmatic approach (Seale *et al.* 2004) to demanding ontological and epistemological considerations. These decisions lead into the research design of my practitioner-based case study (Scott and Morrison 2006, Lofthouse *et al.* 2012), which had its foundations in a co-production approach (see section 2.4.2) that enabled the participants and I to work collaboratively in setting the direction for the actual project we developed.

Next, attention is given to how the case study was constructed (Thomas 2011b, Thomas 2016), from recruiting participants onwards, followed by a justification of the use of a research diary, interviews, and participant observation as data sources for my research approach, alongside reflections on the challenges that developed in the practical use of these methods. Through these reflections, I illuminate the benefits of thinking critically about the appropriate use of methods and their possible impacts on research.

Then, I provide a detailed exploration of research ethics (e.g. Guillemin and Gillam 2004, Alderson and Morrow 2011b, Basit 2013) – particularly the tensions around informed consent, child protection, and confidentiality – which impacted on the co-production nature of my research, and are themes that are developed further within chapter 4. The chapter concludes by reflecting on how the data were analysed using a thematic analysis foundation (Braun and Clarke 2006, Thomas 2013) alongside consideration of the limitations of my research approach and implementation.

As a point to note, due to the participative nature of my project, there have been a number of challenges in deciding what describes the research design and what actually constitutes data from the collaborative research with the young participants. In some instances, it may be legitimately argued that my critique

belongs within both the research design and the later chapters that explore intergenerational and ownership challenges. However, the narrative presented here makes the most sense for me, and I hope the choices made in writing this thesis in such a manner are seen as justified.

3.1 Responding to the research questions: epistemological and ontological considerations

Within the previous chapter, I articulated my focus on young people's insights around their engagement with science, and identified contributory dimensions that would influence my research approach, such as agency, expertise, and diversity. Given my primary research focus, this thesis takes a pragmatic approach to the ontological and epistemological foundations for my research. This is not to say that I haphazardly concoct my research foundation. Instead, the onus was on the considered justification of the decisions I made from this open original stance (Seale *et al.* 2004). For example, with my natural science background, the assumption of value-free knowledge has some appeal (see also Greenbank 2003). However, from the outset of developing this research project, the notion of value-free knowledge could never be suitable for the explorations of the social world I would be undertaking.

Therefore, if I align with any ontological position it is the simple version of critical realism, which Dobson (2009) outlines based on Bhaskar's series of works. A more general attempt to define critical realism is provided by Archer *et al.* (2016):

> Critical realism situates itself as an alternative paradigm both to scientistic forms of positivism concerned with regularities, regression-based variables models, and the quest for law-like forms; and also to the strong interpretivist or postmodern turn which denied explanation in favo[u]r of interpretation, with a focus on hermeneutics and description at the cost of causation.
>
> Defining critical realism is not an easy task. […] It is, rather, a meta-theoretical position: a reflexive philosophical stance concerned with

> providing a philosophically informed account of science and social science which can in turn inform our empirical investigations.

Therefore, critical realism attempts to occupy the middle ground between the supposed extremes of a single reality and multiple realities. Consequently, in line with Dobson (2009), my guiding notion is that on one level, there is a real world out there regardless of whether or not it is being experienced by human minds, and on another level, there is what we – as human beings – experience and make sense of. It is this latter level that applies to the research questions I developed for this study: collaboratively exploring the insights of young people towards their experiences of science, generate understandings of their preferences, and how they could meaningfully contribute to their science experiences. However, I do not insist that always connecting these two levels together is necessary, and therefore depart from the critical-realist-based postpositivistic paradigm that includes this assertion:

> There is a single reality, but we may not be able to fully understand what it is or how to get to it because of the hidden variables and a lack of absolutes in nature. (Lincoln *et al.* 2011: 102; see also Guba and Lincoln 1994)

Studying the empirical level – what we experience and comprehend – is independently valuable. Thus, I wanted to place the participants' perspectives at the heart of a genuine exploration in order to explore my questions. Focusing on participants' views and insights in this way means that my research aligns with interpretivist and constructionist paradigms (Ormston *et al.* 2014): the values and interpretations of the participants – and myself – would be key in actively developing a project-level inquiry (Lincoln *et al.* 2011) that enabled appropriate exploration of the research questions.

To achieve my goal of a genuine enquiry into young people's insights, I established an advisory group of young people, both to work closely with them as well as to involve their perspectives as early as possible within the project. Our collaboration enabled the construction of mutual understandings and the creation of our local reality (Lincoln *et al.* 2011). But the aim was not just to understand the perspectives

of young people, but to take this further by combining perspectives and to suggest how the world ought to be: the basis of co-production. Working in this way necessitates the incorporation of participant values within a practical process and required me to work reflexively throughout all research stages (Ormston *et al.* 2014).

Within research, based on a pragmatist stance, reflexivity is a mind-set and process where researchers seek to actively question each element of the approach they are undertaking. As Basit (2013: 509, quoting Basit (2010)) states: "Reflexivity entails reflection, introspection and critical self-analysis." In this way, the researcher needs to be aware of the decisions and actions that they make throughout their project and the potential impact these decisions and actions could have on the data produced. For example, the researcher cannot simply accept a set of methods aligned to a paradigm as if they are perfect tools to elicit data in an unproblematic manner. For my own project, as outlined later in this chapter and consistent with my pragmatic stance, I borrowed methods that together may be regarded as ethnographic in nature. However, ethnography is generally described as an all-encompassing approach where researchers go into a pre-existing community to explore the dimensions of a particular cultural or societal group over time (Creswell 2013). I did not do that within my research, as I put together the community (i.e. the advisory group) and we developed our own culture together.

Therefore, instead of adhering to a "methodological straitjacket" (Ormston *et al.* 2014: 19), there needs to be consideration of the suitability of different methods for the context in which they will be utilised: e.g. Are there alternative methods to elicit data? Could a question be posed in another way? These questions relate to methods, but reflexivity is much more than this, it is "…an active, ongoing process that *saturates* every stage of the research" (Guillemin and Gillam 2004: 274; emphasis added). Saturation is an important element in the definition: reflexivity is not an addition to the research, to be bolted on at the end of an interaction, it pervades every aspect of the research process from the very outset, as I attempt to

illustrate throughout this chapter, as well as in my findings. This attention to reflexivity is also present within my research-design decisions, and it is to these that this chapter now turns.

3.2 Research design

In this section I reflect upon my status as a public engagement practitioner and how this influenced the possibilities for co-production within my research. I also justify the use of a case study approach as a flexible methodology that aligns with my pragmatic and reflexive approach.

3.2.1 Co-production through a practitioner case study

One lens for this study is practitioner research, in which a practitioner looks to improve an element of their own practice through their own study (Scott and Morrison 2006) with the enquiry originating from a topic or issue that the practitioner themselves has identified (Lofthouse *et al.* 2012). In my current Engagement Manager work-role, the focus of public engagement has increasingly been on mechanisms that enable the incorporation of citizens' perspectives within the practice of science, which has been reflected in the increased attention on consultation and participation (explored in the previous chapter). This does not mean that the communicative mode of public engagement had disappeared from practice, only that greater attention was given to other modes. However, without wanting to establish a difference between adults and young people, it seems that when it comes to engaging young people, there has been no equivalent shift in encouraging consultative and participative engagement with science (e.g. Bucchi and Neresini 2007, Delgado *et al.* 2011, Stilgoe *et al.* 2014). This absence was the launchpad for my research project: if there were to be a shift, would there be interest from young people in consultative and participative engagement? Although I had received feedback from children and young people in relation to the communication-based events and school visits I had undertaken, I had never

attempted a broader exploration of insights that encompassed all modes of public engagement.

With my ontological and epistemological requirements for a flexible research foundation and the foregrounding of perspectives from participants, the case study methodology (similar to practitioner research as a wide-ranging concept with comparable underpinning conceptions) was a suitable option for my research project. According to Miles (2015: 311): “A case study provides context-dependent knowledge and accounts of practice that are drawn together from the voices, actions, interactions of the carriers of practice in a site.” For my case, the ‘practice’ was public engagement with science and the ‘carriers’ were those involved in the engagement processes: young people and public engagement with science practitioners. Since I was a practitioner myself (and still am at the time of writing), the main ‘carrier’ of interest for my research was young people.

The exploratory nature of my case is core to the qualitative tradition (Morrison 2012) and is recognised as fundamental to many case study research projects. In Yazan’s (2015) comparison of three prominent proponents of the case study methodology, he demonstrates that Stake and Merriam both regard the case study as an interpretivist approach that recognises multiple perspectives, while Yin is portrayed as having positivistic leanings. However, through his most recent guide, Yin now also recognises that interpretivist and relativist positions can be addressed through case studies: for example, through the use of the term “findings” instead of solely “facts” (Yin 2014: xxiv).

Furthermore, there are differences in how flexibility in case study research is perceived. In Yazan’s (2015) review, it is revealed that while some (e.g. Stake and Merriam) endorse the ability for case study research to adjust as the study progresses, others (e.g. Yin) contend that no major alterations can be made during the course of the research. This variability in views is to be expected due to the range of cases that could potentially be at the centre of this research approach, and demonstrates how a reflexive mind-set can support researcher decisions. For the

exploration suggested through my own research questions, I aligned with the suggestions of Stake and Merriam: the structure of the research needs to be altered to fit the requirements of the approach and be reactive to the central research focus.

The capacity for the development of participants' views was a key benefit of the case study research approach founded on a young person advisory group (see Richards-Schuster 2012, Roholt and Mueller 2013), as this offered greater possibilities for the deep exploration of the multiple concepts at the heart of my research questions. It is unlikely, for example, that my participants would have contemplated notions around public engagement to any depth prior to their involvement in this project; the exploration over time offered by an advisory group approach was a distinct advantage to the approach. Therefore, conceptually, my research project was a nested, diachronic case study (Thomas 2011a). It was nested since different tasks were undertaken by the participants and each task contributed to varying degrees to the overall research questions. It was diachronic as perspectives had the potential to change over the course of the study due to participants having greater exposure to the idea of public engagement with science through our interactions.

In addition, societal contexts are complex networks and require approaches that recognise this complexity. The case study approach, through the possible recognition of networks of people and materials situated in time and space, was ideal for these demands within my project, given that "the aim [of a case study] is to gain a rich, detailed understanding by examining aspects of the case in detail" (Thomas 2013: 150). Furthermore, the case study places perspectives and values of all contributors at the centre of the study. In contrast to some other methodologies, the case study approach recognises the role of the researcher and incorporates it as part of the process. This consideration presented a further advantage as my work role was significantly intertwined with this project, so attempting to overlook my positionality within the study was impossible.

Summing up, the case study approach offered a suitably flexible framework in which I could address my research questions. However, within this framework, it was beneficial to consider the power dynamics within my intergenerational co-production project.

3.2.2 Co-production and power dynamics: an intergenerational collaboration with young people

As elucidated in the previous chapter (specifically section 2.4), power is part of a range of actions and reactions (Gallagher 2008) and therefore can be exchanged between participants and researchers throughout various research stages (O'Brien and Moules 2007). This idea of power being dispersed and being present within small-scale, as well as large-scale, decisions and processes is important for the notion of co-production. From the outset, this conceptualisation has the potential to enable all participants to influence and impact all others in the project, and not just have a single participant – such as the adult – who controls every stage of the research process.

Consequently, within intergenerational research, it is insufficient to solely consider the exchange of power between the adult researcher and young participants, power dynamics also exist between the young people involved in the project. In their review of challenges for research with children as co-researchers, Bradbury-Jones and Taylor (2015) highlight that young people who already have social research training or are relatively more articulate can be given a special status in research projects, and the relationships between young people lead to some opinions being promoted whilst others silenced. Arguably, these claims also apply within adult-only research projects too – decisions are made on which opinions to pay greater attention to than others – but what this review reminds us is that attending to power relationships within an intergenerational project is not just a case of considering how the adult engages with the young participants, but also how all participants are interacting with each other.

However, it is argued that there is an increased risk of power differentials in relationships between adults and young people (Sinclair 2004), so intergenerational relationships should not be disregarded, especially as adult researchers can have a significant role in setting the tone for the project participants. In the Swedish intergenerational research project undertaken by Åkerström and Brunnberg (2013) with young women (15-19 years old), elements of co-production are present as the researchers are committed to involving different perspectives to improve knowledge on the specific topic of participation. However, the project appears to be adult-led throughout: for example, decisions on the categorisations of data and the need for research-methods training appear to be made independently by the researchers (Åkerström *et al.* 2015). The adult researchers themselves recognise that some of their actions may have negatively impacted the participative nature of the project (Åkerström and Brunnberg 2013) limiting the potential for the findings from their work. The problematic inputs of the researchers stem from their initial standpoint that "In terms of power, however, adult-child relations are vertical…" (Åkerström and Brunnberg 2013: 529). By having this fundamental outlook towards their project, the adult researchers immediately curtailed the open dynamics of their group and limited the scope of contributions from their young participants.

In contrast, some scholars contend that for young people to be at the centre of the process, there is a need to start from what the young people themselves consider important to explore and work in a genuinely participative manner – together these enable a collaborative approach to be established (Davis and Smith 2012) within a process of co-production. For my research and its commitment to a co-production approach, I was aware of the potential for me to claim a directive role (in a sense of vertical power between myself and the project participants), but it was important for me to engage with the view of power as a negotiable part of all relationships within the research group which was present through our actions, from the smallest response through to the largest decisions (Gallagher 2008). For example, in contrast to Åkerström *et al.* (2015), I introduced the possibility of training to the Young SAGE participants and sought their views on whether this would be beneficial; I did not

impose my decision on the group. The exchanges around this, and similar aspects of my project, are analysed in chapter 5. With the intergenerational case study approach described, including acknowledgement of power dynamics, attention now turns to how the case was established and my justification of different data-collection methods.

3.3 Undertaking the case study

Given my commitment towards co-production, the case study approach provided greater flexibility in enabling the ideas of project participants to play a genuine role. Within the case study, I utilised a variety of methods in order to gather data in an appropriately flexible manner: my personal research diary, individual interviews with all participants prior to their project involvements, and then – as we collaboratively developed a new project – participant observation which allowed me to focus on the participants' perspectives of science experiences. Participants who left during the project were invited to provide their final thoughts on the project through exit interviews.

An important note is that my research attention was on the perspectives of the Young SAGE participants rather than any other children and young people we engaged during the project. I begin this next section by providing a project overview to aid the reader in understanding the progression of the Young SAGE collaboration.

3.3.1 Young SAGE project timeline

Due to the collaborative nature of the Young SAGE initiative, the progression of my research was highly dependent on the decisions the participants and I made together, including when the gatherings should take place through to key milestones for the development of an interactive event for early secondary school pupils (see Appendix 1) with surveys before and after to explore the impact of the experience. Therefore, the following table summarises the main project highlights, with the subsequent sub-sections reflecting on the research methods I utilised.

Date	Gathering	Priority / focus	Interviews
2016			
May		Recruitment started.	
Sept		Pilot session held at one school.	
Nov			Introductory: Megan; Emma; Alissa; Rory; Helen; Jess; James; Luis; Lisa; Laura (who withdrew Dec 2016)
Dec			
2017			
Jan	1st	Icebreakers; group rules; reflect on science experiences.	Introductory: Mark
Feb	2nd	Completion of reflection on science experiences; start to consider project.	
Mar	3rd	Participants' idea of event over several days with surveys before and after.	Exit: Laura (via email)
Apr	4th	Added idea of initial survey of senior pupils. Event to be for primary pupils.	
May			
Jun	5th	**Aim to hold event in Nov 2017** with local institutions supplying content. Aim for early secondary pupils not primary.	
Jul	6th	First draft of senior pupil survey. First draft of ethics application.	Introductory: Dean Exit: James
Aug	7th	Revised **senior pupil survey and distributed** after this gathering.	
Sept	8th	Analysis of senior pupil responses. Initial drafting of pre-event survey.	Introductory: Sarah Exit: Luis
Oct	9th	Further drafting of pre-event survey. Discussion of event venues. Aim for **event moved back to Feb 2018**. Drafted introduction letter for teachers.	
	10th	Completed introduction letter for teachers. Pre-event survey edited; post-event survey drafted.	
Nov	11th	Post-event survey confirmed. Group interview questions drafted. Team T-shirts idea suggested.	
Dec	12th	**Event to be single day** to be more manageable.	

Date	Gathering	Priority / focus	Interviews
2018			
Jan	13th	**Event idea retained: late Feb / early Mar.** **Pre-event surveys to be distributed.** Approaches to potential venues made. Email to **potential stall providers** drafted.	
	14th	**Pre-event surveys: one school received responses; others not yet distributed.** Venue choice for event made. Drafted letter to parents.	
	15th	**Confirmed venue booking form: 1st Mar.** Discussed stall provider offers. Redrafted post-event survey. Dropped group interview idea.	
Feb	16th	Teacher letter: specific event introduction. Updated parent information letter. T-shirt idea progressed.	
	17th	Check on stall-provider requirements Discussed evaluation techniques: informal observations and suggestions box selected.	
		Event postponed to 20th Mar: schools needed more time to make arrangements.	
Mar		**Event: two sessions; two schools.** Post-event reflection discussion. Post-event surveys distributed to schools.	
Apr			
May	18th	Held after twice postponing. No post-event surveys data; reviewed suggestion box comments. Discussed Young SAGE Social idea and how to share our learning.	
Jun	19th	Held after postponing once. Young SAGE Social discussed. No post-event survey data; themed suggestion box comments. Ideas for 'report' made.	
Jul	20th	Held after postponing three times. No post-event surveys data. Reviewed project from first gathering. Reviewed my draft learning points. Looked at survey data; project report plan.	

Figure 3: Young SAGE project timeline

3.3.2 Seeking participants: putting the advisory group together

Utilising Agar's (1996) five sampling conceptions within ethnographic settings, my approach to sampling was a combination of judgemental (i.e. seeking specialists in an area of interest to the study) and opportunistic: I prioritised seeking 14-17 year olds (i.e. in the final three year groups at local secondary schools), as well as those who wanted to be involved in the study. The possible alternative of a stratified sample (representatives fitting predefined characteristics) did not align with the exploratory nature of my research questions. Beyond recognising the limited academic attention to young people and public engagement with science practice, there was not a specific group (beyond 'young people') that I aimed to involve in my research. Also, a fundamental premise of participatory research is the free choice for participants to take part: by approaching pre-identified individuals, I could have pressurised those individuals to take part.

However, in contrast to entering an existing context that Agar (1996) implicitly assumes in his overview, I did not have a ready-made community within which I could adequately explore my research questions. Consequently, I planned to establish a young person advisory group: an intergenerational format providing the possibility for "…shared decision making with young people, where youth learned about issues, conducted research, and brought information back to the group" (Roholt and Mueller 2013: 84). The advisory group is a flexible approach which supported the participative nature of the project I aimed to undertake within a collaboration with young people.

3.3.2.1 Initial recruitment attempt

Being optimistic at the beginning of the recruitment process, I initially only promoted the existence of the advisory group through an existing contact at the local council (who had links to all science teachers in the local authority), as well as high school teachers through whom I had previously arranged events through my work role. As part of this promotion, I supplied an information / application form

(see Appendix 2) as well as a colour A3 poster (see Appendix 3). Within this first form of contact, I tried to emphasise the spirit of collaboration:

What will this young person group do? I'll work with the group, sharing ideas and deciding together what and how we should do things. Some possible ideas are:

- Have regular one-hour gatherings (e.g. every six weeks in a year).
- Work together on a plan to explore the views of young people (we can adjust this plan later).
- Investigate existing science experiences for young people.
- Develop our own science experiences for young people.
- Probably combine lots of your ideas!

Figure 4: Excerpt from the Information/application form describing the possible priorities for the advisory group

Through including the phrases "sharing ideas and deciding together", "some possible ideas", "we can adjust this plan later", and "combine lots of your ideas", my aim was to outline the concept of the project, but also establish the ethos of collaboration and co-production which I sought to foster throughout the project. Similar to the approach of Sarre and Moran-Ellis (2014), I worked through my network of contacts to direct my recruitment efforts towards young people directly, rather than seeking parental permission first. However, just like Sarre and Moran-Ellis (2014), I had to expand my strategy after my initial effort achieved minimal success.

Unfortunately, by early July 2016 (i.e. the start of the summer school break), I had only received one application form, prompting some personal reflection:

> **The lack of applications is an issue, but I need to somehow engage with some young people at least to work out how to better attract young people to the project. Once I have some [young people] interested in the project, then this may enable me to improve the process through their advice. I should also look into developing a digital presence, so that this would provide a baseline for the project – something tangible upon which other aspects of the project can hang from, like a Wordpress site. It would, for example, give a publicly accessible space for people to find out more about the project, and**

could be a recruitment vehicle too. (Research diary, Thurs 30th June 2016)

I had naively assumed that sending information through teachers – either directly or through my council contact – would easily enable me to reach a sufficient number of young people (perhaps even significantly more young people than I aimed for) so I could establish the advisory group before the summer school break. Despite the confirmed support from the council contact and several teachers, this initial approach did not succeed in achieving my target of ten participants – a target based on advice from focus group literature (as summarised by Hopkins 2007), where a mix of voices would still be present even if some participants could not attend a specific gathering. My difficulty here reflects claims that recruiting young people for research outside educational settings is more time-consuming than many researchers and youth organisations predict (Brownlie *et al.* 2006, Powell and Smith 2009). Furthermore, I had overestimated the potential to reach my intended audience through schools in the period just before the summer break.

3.3.2.2 Renewed recruitment strategy

This recruitment set-back led me to reconsider how to successfully attract participants by: 1. gaining insights from any initial applicants about alternatives through which I could engage other young people with the project, and 2. setting up a website through which further information about the foundation of the project itself could be shared. The presence of a website would potentially provide more confidence that the project was a genuine one, instead of solely just sending out isolated emails about the planned group.

As well as having a dedicated website to offer greater depth to the information available publicly, I decided that a working title for the group (and overall project) could be beneficial. Having a working title allowed the project to be discussed more easily and began to provide an identity, rather than using a more generic term such as “young person advisory group”. After some agonising, I eventually chose the name Young SAGE (Young Science Advisory Group for Engagement): it included all

the key descriptive terms whilst being something that had a suitable alternative meaning since 'sage' is linked to the concept of wisdom.

After the project website had been setup (Appendix 4), I then undertook a variety of actions over several months in order to recruit Young SAGE participants:

Tactic	**Detail of actions**	**Applications received**
Email local school and local authority contacts	a) Sent link to project website, revised information/consent form, and poster.	2 (Rory / Lisa)
	b) Invitation to host introductory focus group for some senior pupil classes.	0
Teacher invitation to meet their class	Ran introductory focus group with one science class in a single school.	3 (Alissa / Emma / Jess)
Initial applicants inviting peers	Suggestion to original applicants to raise project with peers.	3 (Helen / Megan / Luis)
Social media dissemination	Several tweets with youth organisations tagged; link to information/consent form.	1 (Mark)
Online science teaching forums	Contacted online science teaching forum administrators to post project details.	1 (James)
SCI-FUN Roadshow opportunities	Briefly outlined project to senior pupils during one SCI-FUN visit. Sent posters to another school with post-event letter.	0
Other organisations	Information sent to other groups such as local Scouts / Barnardo's sections, and through other Council departments.	0

Figure 5: Recruitment tactics used within the Young SAGE project

The diversity of approaches employed bears striking similarity to the advice from Mawn *et al.* (2016) based on their study into mental health in young people, where they reached out through a combination of leaflets, posters, presentations, information stalls, and taster sessions. Within my variety of strategies was a mixture of actions deliberately considered in advance as well as serendipitous opportunities that became possible due to my work role. For example, following the email sent through my local council contact after the summer break, a teacher invited me to meet with some of his pupils in support of his aim to develop a science equivalent

to sports clubs for senior pupils at this school. Here was an example of how the gatekeeper affected my plan (see Basit 2013), but in a beneficial manner. After some negotiation, we agreed on an approach where I would explore the pupils' views towards their previous science experiences, and then highlight that this exercise mirrored the Young SAGE project I would develop with young people across the city. The success of this session was reflected by the recruitment of three Young SAGE participants. However, there was a risk that these participants would conceive of me as a teacher since we first met in a school classroom, and they could have felt pressured to participate by the teacher's enthusiasm (Fargas-Malet *et al.* 2010). The fact that I was still in touch with all three of these participants two years later suggests that they also had their own motivations to continue their involvements despite these original risks. Despite invitations to other schools, this was the only introductory session held.

Going beyond the advice of Mawn *et al.* (2016), and using tactics from an advisory group setting (Richards-Schuster 2012), encouraging earlier applicants to discuss the project with their peers succeeded in raising further awareness. This encouragement – in conjunction with the information that had been sent to schools earlier – appeared to help:

> **…there was a poster on the wall I thought, yeah […] there was kind of only one on [teacher's name] window […] and you know her, apparently […] I don't have her as a teacher but my physics classroom is right beside hers and we were waiting outside and I was just reading the stuff on the window [poster], so I thought it looked kind of interesting so I took a picture of it and then I showed it to Helen… (Lisa interview, 22nd Nov 2016)**

Lisa's description suggested that not only was the brief introduction to the project provided by the poster important, but it seemed to help that I was a known person to the teacher who had displayed the poster, perhaps leading to a level of trust that the project was a genuine project. Therefore, this teacher-gatekeeper contributed in a positive sense on the participation individual (Powell and Smith 2009). From Helen's perspective:

> **…[the project] sounded really interesting on the poster […which was…] outside one of the science classrooms […] and then Lisa told me about it, cos I don't do physics anymore and it was in the physics department so she [Lisa] told me and then we went to look at it. (Helen interview, 28th Nov 2016)**

Here, it seemed that the chance of Helen discovering the existence of the project would have been close to nil without Lisa' action. As well as (eventually) seeing the poster, reflecting on the opportunity with Lisa could have reassured Helen since she would know another person involved with the project. It has been recognised that young people may be encouraged to become involved when they work in friendship groups (Mayall 2000, Hill 2006), however there can be issues in that the 'leaders' of these friendship groups dominate discussions (Krueger and Casey 2015). For me, the possible domination of views was a lesser concern, since the aim was for participants to come from different schools and for the project to exist for longer than expectations for focus group research. Also, as suggested in a young person's guide to social research, having a discussion as an "…individual [chat] can get kind of awkward…" (as quoted in Students at Shawlands Academy *et al.* 2016: 9). Therefore, Helen may have had greater reassurance and confidence of knowing that there would be at least one person attending that she knew in advance.

Another advantage of the project website was that it provided a good foundation for social media approaches to attracting further participants away from solely though formal school-based mechanisms. Instead of using my own personal account, the tweets were sent through the @ScienceUoE twitter handle since this had been operational for 18 months more than my own account, had a greater number of followers, and had a more easily perceived link with the University of Edinburgh (possibly enhancing trust by using this channel).

As part of my tweets, I tagged several youth-related organisations in Scotland – with a combined follower total of approximately 42,000 – to raise awareness of the project beyond school settings. A tweet sent on the 3rd October 2016 particularly resonated as it was retweeted 16 times within 24 hours: "#EdUni is looking for S4-

S6 pupils in #Edinburgh for a new #science advisory group: https://ypagdunbar.wordpress.com/ Something for applications?!" By pinning this tweet to the @ScienceUoE page, greater ongoing engagement was possible and resulted in further retweeting on irregular occasions. The result was a single additional application:

> **As Mark and I were leaving the café [after his introductory interview], I remembered to check on how he found out about the project; especially interesting, since I hadn't been in direct contact with his school. Mark's Dad had seen the tweet online and mentioned the project to Mark and encouraged him to get involved. (Research diary, 11th Jan 2017)**

The role of Mark's parent in facilitating his involvement with the project is an integral part of the process: without his Dad seeing the tweet, Mark would not have been aware of the project. This scenario illustrates the gatekeeper-power in a negative sense (Powell and Smith 2009), since one of Mark's teachers would have received project information through the council, but did not disseminate this in a way that Mark noticed (if they disseminated the information at all). Instead, Twitter indirectly enabled Mark to be informed about the project through an alternative gatekeeper (his father), demonstrating the value of incorporating social media within the recruitment strategy.

3.3.3 My research diary: brief reflections

My research diary enabled me to record the project's progression alongside my own thoughts and provided contributions towards identifying potential findings for my overall research. Within any research diary, not only should descriptions be captured, but also the author's own ideas, reactions and interpretations as soon as possible (Thomas 2011a), including explanations of the decisions taken and initial analytical thoughts (Burgess 1981), as the following excerpt demonstrates:

> **I undertook the introductory session at [School name] with the Higher class suggested by the contact teacher. Unfortunately, the room could not be prepared in advance (moving the tables, getting the discussion**

rules list up on the wall, having the writing materials out), so this had to be done whilst the pupils were there. They were an excellent group of people, so this was not a major issue, but it would have been better to get straight into the session when they arrived. Although I stated at the beginning that the participants should talk between each other (in a focus group style), that wasn't the way things turned out: it was really a group interview, with me asking the questions and the responses being made directly to me and not the others around the table. This could have been to do with how the questions were asked as well as the participants being sat almost in a horseshoe shape around me. I did attempt to encourage discussion between the pupils on a couple of occasions, but this was not successful. Another limitation was the time: there was only about 40 minutes (after the setting up of the room) to talk about science experiences and the positives and negatives of these – as well as intro my project – so I skipped a potential icebreaker (partly due to time and partly due to the fact they were an existing class so would have known each other previously) and got into the first question after setting the scene for the session.

About half-way through the session, I was aware that I was trying to summarise the comments from the participants immediately after they had given them, and I may have extended their original thought on their behalf rather than getting them to clarify first. Something to listen out for when transcribing the session. This could be a trait that I have from my teaching experience… (Research diary, 15th Sept 2016)

This excerpt includes reflections on the school-based introductory session and aligns with some critiques of writing fieldnotes reviewed by Emerson *et al.* (2001). The sections of my diary entries that were mainly descriptive – i.e. what the session was and setting up the room – were written in standard font. As a contrast, my own explanations and reflections – i.e. whether it was a genuine focus group, why the planned icebreaker was omitted, potential issues with my summarising of participant comments – were written in red and underlined in order to make these visually distinct, thus aiding later reflection.[23] In contrast to Engin (2011), I did not physically separate the description of actions from my reflections and initial analysis

[23] I have retained the original formatting from my research diary here to illustrate my approach, but as the visual distinction is not beneficial for the reader beyond this illustration, I have not preserved the formatting in other research diary extracts included in this thesis.

since they were so interdependent: writing them separately would not have reflected the complexity of the data.

Following Thomas (2013), my research diary was a combination of interval-contingent, where I made entries on my computer at regular intervals (i.e. almost every day), as well as event-contingent, where entries are made as soon as possible after specific instances (i.e. advisory group gatherings). As a part-time PhD student, prioritising the regular writing of entries into my research diary – no matter how brief – was an important action to maintain my research focus. Especially during busier work-periods, it would have been easy to relegate my research progression: as Gatrell (2006) argues, paid work can frequently claim priority over study time. However, my self-determined insistence to frequently write in my research diary maintained my connection to the project and provided a routine that full-time students arguably achieve more easily through their shared-study ethos (e.g. jointly visiting the library with other students, attending seminars, or quietly writing side-by-side) and regular engagement with other students (Gatrell 2006). My research diary became a point of stability in an otherwise chaotic balance of work and research responsibilities.

Instead of writing notes under specific headings, I kept a "chronological journal" (Okely 2002: 23), which included only the date and space for me to write. This unstructured approach encouraged me to explicitly reflect upon, and tentatively analyse, experiences I thought worth recording. The mix of description, reflection, and occasional nascent analysis greatly assisted my later analytical process. An advantage of my part-time status was the possibility to step away from these original reflections and make further assessments (Okely 2002). An example of this can be seen in the previous section regarding my recruitment process: I had thought that developing a website would assist with attracting more participants to the research, but as Figure 5 highlights, this was only one action amongst a range of actions that contributed towards an improved strategy for seeking participants.

Maintaining a record of what took place was important, not only to support my analytical process, but also to contribute towards my descriptions of what happened to support my aim for credible research in the judgement of others: "Such [thick] descriptions of both the site in which the studies are conducted and of the site to which one wishes to generalize are crucial in allowing one to search for the similarities and differences between the situations" (Schofield 2009: 76). Within my research, I prioritised the capturing of participants' perspectives and actions, so that this information could be incorporated into my findings and therefore enable others to assess how these could apply to other contexts.

Within qualitative research, diaries are a useful data-source: the noting of a single comment or action within a single moment has the potential to provide insightful research data (Okely 2002), as shown by Corner's (2012) exploration of her own teaching practice through a creative learning project, where she relies on her own reflections of incidents. One specific example concerns the description of a made-up illness to which the pupils initially responded with silence and then one pupil asked if the illness was real. This incident is perceived by Corner (2012) as the pupils absorbing the information ahead of a crucial moment of revelation. However, the credibility of Corner's analysis would have been heightened by drawing on other data, such as reflections from the pupils. Thus, research diaries provide a useful reflection and recording method within qualitative research approaches, but by including other methods within my study – such as individual interviews and participant observation in the group gatherings – I sought to improve the credibility of my research.

3.3.4 Individual interviews during the introductory phase

Prior to participants meeting for the first time, I conducted semi-structured interviews with everyone individually. All interviews were audio-recorded to assist my recall and to ensure that participants' descriptions were retained in their own words. Although it is argued that individual interviews may not be suitable for some

young people as they might be naturally shy (Hill 2006) and feel uncomfortable with one-to-one discussions with an adult (Gallagher 2009), these interviews provided an opportunity for participants to clarify any uncertainty given the necessarily vague nature of some details within the information/consent form, as well as ask any other questions prior to meeting the entire group. These interviews also enabled me and the participants to find out more about each other, and so were a chance to build rapport ahead of the group gatherings and for me to start building trust with the participants (see Gibson 2012). As a result, the individual interviews sought to build participants' confidence ahead of the full group gatherings.

Semi-structured interviews provide a constructive middle-ground between structured interviews – a set of pre-planned and faithfully delivered questions – and unstructured interviews, which are more akin to a natural conversation (Thomas 2011b). Since my research had an exploratory ethos, I considered using unstructured interviews, but this was riskier due to my nascent researcher status (cf. Gesch-Karamanlidis 2015): if the conversation became stilted, I would have needed to be nimble in diverting our dialogue along a more constructive path that benefitted my research interests. Additionally, I wanted to ask about practical matters, such as allergy information and preferences for group gatherings, so reminders about these were helpful. Therefore, following Thomas (2013), my semi-structured interview schedule included a set of core questions with potential follow-ups (Appendix 5). This schedule was a flexible support (in the manner of Seidman 2006) for creating conversation through adjusting to opportunities to explore points as they arose rather than being merely a rigid script.

In addition, as a slight deviation from the notion of having probes within the interview schedule (see Thomas 2013), I developed a separate sheet of probes – a set of generic prompts – which I used to encourage further elaboration. Thus, my probe sheet was a more versatile document (Appendix 6), independent of my main interview schedule, which I further used within the group gatherings. My semi-structured interview approach ensured that I planned my core areas of interest in

advance and provided me with a greater sense of confidence ahead of these introductory interviews.

In addition to the interview schedule document, reflecting on the advice of Seidman (2006) helped to mentally prepare for the interviews. Some advice made immediate sense, such as using probes to explore for further details, and clarifying when necessary. Some advice was potentially problematic and needed to be employed with care. For example, Seidman's (2006) guidance about using silences to encourage participants to elaborate further depended on the interview atmosphere: at times, a five-second silence felt appropriate and would lead to further information from the participant; for others, this length of silence would not gain further detail and risked a stilted discussion and awkward atmosphere if the gap in discussion continued.

Other advice from Seidman (2006), although appropriate, was more difficult to put into practice. As a nascent researcher, I followed the suggestion of Gesch-Karamanlidis (2015) in reflecting on my earlier interviews in order to identify my interviewing weaknesses. One issue I identified was a tendency to occasionally interrupt the participant:

> **James: …over the past year or so I've been working with the digital logic design using FPGAs, a Professor of…**
>
> **<u>Stuart: Using?</u>**
>
> **James: Field Programmable Gate Arrays.**
>
> **Stuart: Thank you very much.**
>
> **James: …that's just designing chips from the ground up…**
>
> **Stuart: Yep.**
>
> **James: …I talked with a professor at university in… [James interview, 18th Nov 2016]**

This example above was one of two interruptions during this discussion with James; the interrupting comment is underlined. Within this interview, I was struggling to

hear James due to the background noise, and I wanted to ensure that I was following his description. By interrupting the participant, I ensured that I gained clarification, but I risked the participant losing the rest of the opinion or information they wanted to provide (Gesch-Karamanlidis 2015). I was fortunate on this occasion as James appeared unphased by my interjection and freely continued with his comment. However, with Megan's interview, I was not so fortunate:

> **Megan: …there was a theatre in the museum and there was a talk on, I think it was different types of renewable energy, yeah…**
>
> **Stuart: Yeah.**
>
> **Megan: …that was pretty interesting. I don't quite remember because that was about two years ago. Yeah so I can't really tell you much on it, but I felt, I can tell you that I found it really interesting.**
>
> **Stuart: Okay.**
>
> **Megan: Since…**
>
> **Stuart: Can…**
>
> **Megan: ...What?**
>
> **Stuart: ...sorry...**
>
> **Megan: Sorry, go on.**
>
> **Stuart: Can, can you remember why it was interesting?**
>
> **Megan: Because we actually got to be involved, you know, with experiments… [Megan continues with her description.]**
>
> **Stuart: Sorry you were going to say something else and I interrupted you badly.**
>
> **Megan: It might come back to me…**
>
> **Stuart: A lesson for myself…!**
>
> **Megan: Oh, and not necessarily… [proceeds to move on to start another description of a science experience] (Megan interview, 16th Nov 2016)**

Again, my interruption comments are underlined in this complex example: I was successful in gaining further information about why the particular science experience was 'interesting', but I had cut into her train of thought and was unsuccessful in helping her get back to what she was going to say. It could be argued that this type of interactive dialogue contributes towards having an informal conversation which can build rapport and trust (e.g. Gibson 2012), but here I potentially lost some insightful information.

3.3.5 Young SAGE group gatherings: participant observation and progressing from introductory group gatherings

A further data-collection method from the first group gathering onwards was participant observation. This is where the researcher engages with the setting in which the research takes place (Coffey 2006) and it involves "…talking to people, watching, reading documents, keeping notes and anything else that enables [the researcher] to understand a situation" (Thomas 2013). As the review from Emerson *et al.* (2001) demonstrates, there are a number of approaches to producing fieldnotes during participant observation, although there is some consensus that they are a fragmented record of potentially significant people, events, and researcher reactions, some of which will contribute to the data within final writing. In combination with brief jotted notes (Emerson *et al.* 2001) on participant seating locations during gatherings and potential points of interest within our discussions, I audio-recorded the group's conversations to avoid a reliance on my own recall. As Coffey (2006) suggests, it was difficult to take detailed notes during the group gatherings, especially due to being an active part of the discussions and not just as a passive observer of the setting. Therefore, I audio-recorded some reflections immediately following our gatherings, as well as writing further thoughts within my research diary. The jotted notes I made during the group gatherings were mostly reminders on times in the recordings that could be more important for analysis, as well as to identify who said what in order to assist the attribution of comments within transcriptions.

In contrast to others who use participant observation as part of ethnographic studies, I did not have a 'natural' setting (Coffey 2006) to observe. My study relied on the development of a specific setting – the Young SAGE group – and so I was not entering the field in a traditional sense, but creating one alongside the young participants. According to Gibson's (2012) reflections on focus groups, working with young people requires careful planning to improve the possibilities for participants to contribute positively. However, all facilitators working with new participants should be prepared: planning is not just something required of adult researchers working with young people. The first two Young SAGE gatherings prioritised developing group interactions through introductions in paired discussion, small group discussion on our group's ground rules, and then full-group discussion on the main science experiences that participants had shared through the earlier individual interviews. By progressing the discussion from paired discussion through to full-group discussions in this manner, I sought to reduce the potential pressure on sharing views immediately with the rest of the group (Hill 2006) especially for those who may have been less confident.

Of particular importance was the group development of our ground rules to clarify expectations and establish a suitable environment for positive interactions (Gibson 2007, Gibson 2012). Instead of providing these rules (Gibson 2007), I decided it was more appropriate to involve participants in developing our rules (Davis and Smith 2012) as this inclusive approach aligned with collaborative nature of the project. After a brief role-playing of disruptive behaviours, the participants split into groups of three or four and developed their own sets of group-work rules. This provided the opportunity for the participants to talk to each other without my active involvement. Through this approach, I began to encourage participants to discuss matters with each other, rather than directing every conversation myself. The main rules from each group were then shared with everyone and contributed to the ongoing group-work rules, which were named "Discussion Etiquette" by the participants. Although a minor action, encouraging the group to name these rules was a signal of shared ownership of the project (Shier 2001, Mawn *et al.* 2016). I

analyse this further in chapter 5. During our brief review at the end of our first group gathering, this introductory approach appeared to be regarded positively by the participants:

> **Rory: I think that doing the basic things that you do with group activities and stuff like that, it's quite good in a way because at least you're doing something and you're starting to talk…**
>
> **Several: Yeah.**
>
> **Rory: …it's better than going straight into this [categorising science experiences]…**
>
> **Jess: Breaking the ice.**
>
> **Rory: …most people would probably feel they wouldn't, or couldn't…**
>
> **(Jess: talk about it)**
>
> **Rory: …talk in a group, yeah.**
>
> **Jess: I agree. Breaking the ice first was quite good in fact, where we're now more comfortable with each other and we know more about each other. (1st Young SAGE gathering, 22nd Jan 2017)**

These comments support arguments that young people can feel pressured in a group environment and that the "basic things" scheduled for the initial part of the gathering meant that the participants could focus on just finding out "more about each other" and getting used to talking in a group environment. Not only was I building rapport with the participants (Punch 2002b), but there were also opportunities for participants to have discussions independently, allowing them to develop rapport with each other. Having the small group-discussions for the development of our ground rules, possibly helped with the following activity – the categorisations of the group's previous science experiences – which was based on full-group discussions.

To assist with the categorisations of previous science experiences, I had prepared A4-laminated cards (Appendix 7) with example pictures to reflect a range of experience-types that had been discussed in the earlier individual interviews – an

aspect which was quickly noticed by the group. The use of visual materials are argued to promote discussion (e.g. Fargas-Malet *et al.* 2010) and so it proved with the Young SAGE group. Prior to the categorisation, the participants looked over the cards, some of which included examples that were not familiar to everybody:

> **Stuart: If there's anything you're not sure about, please shout out now, because somebody around the room will [murmurs start in the group] definitely know about it and be able to explain a little bit more if that's necessary.**
>
> **Rory: What's this?**
>
> **Stuart: The PCR workshop. [Several murmurs of recognition]**
>
> **Megan: It seems to be only for girls.**
>
> **Rory: What is it?**
>
> **Stuart: The PCR workshop.**
>
> **Alissa: We had to go like, like part of the University, we got to do a DNA experiment, to extract one of our genes and compare them with our classes.**
>
> **Rory: All right, cool. Was that part of school?**
>
> **Alissa: Yeah it was part of biology a couple of months ago. (1st Young SAGE gathering, 22nd Jan 2017)**

Although Rory's initial question followed my invitation for questions to be asked, this was followed-up by his own direct request for clarification ("Was that part of school?"). Using the initial phase of the group gatherings to encourage direct interactions between the participants was an important aim for the foundation of the project. I wanted the participants to feel comfortable in talking with each other – not just me – and to begin feeling as though they could positively contribute towards group decisions on our project priorities. From the latter part of the second gathering, discussions progressed from a focus around previous science experiences towards considering the project goals.

Within the first two gatherings in particular, the mode of discussion – save for the occasional interactions between the participants – were more like group interviews with me having a leading position rather than a free exchange between everyone in the room (see Kitzinger 1995, Thomas 2013):

> **I was acutely aware of the participants looking to me to lead the group, which is only fair given that I have been driving this [project] and making the arrangements based on their responses, but I will need to ensure that the balance becomes more even as the group develops. For example, most comments in today's session were made towards me, since I was the one asking the majority of the questions, but perhaps there should be icebreakers or tasks in the next gathering where I'm not directing what's going on... (Research diary, 22nd Jan 2017 – date of the 1st Young SAGE gathering)**

As I recognise, I needed to disrupt the assumption that I would be solely directing the gatherings. Continuing in the fashion described in the above excerpt would not have been beneficial in the longer term, since the collaborative purpose of the project would be limited by my directing what we would do and when we would do it. Over the course of the series of group gatherings and the development of our ideas into a research project involving surveys and the planning of an event, there was a structure to the gatherings but this structure – and the timings for our plans – was developed in discussion with the participants rather than me independently setting the agenda. The further development of the project and our collaborative basis is analysed in further detail in chapter 5.

3.3.6 Departing and final reflections: exit interviews

Participants who withdrew from the project prior to summer 2018 were invited to have a semi-structured exit interview to reflect on the project. Although the use of semi-structured interviews could curtail the potential for exploration by pre-limiting the discussion topics (see Houghton *et al.* 2015 as an example of this critique), due to a long period of our interactions, identifying specific project dimensions to explore with participants seemed appropriate. Furthermore, the contention that building rapport with young interviewees is more difficult in comparison with adults

(Thomas 2013) was overcome by the building of relationships during the project's duration, which provided a great deal of shared experience. However, to maintain the possibility for exploration, the first and last questions were open-ended (Appendix 8) and offered flexibility for participants to respond in diverse ways – e.g. "In your view, what are the potential positives about the Young SAGE project?" With our existing relationships, the participants were able to raise topics that they felt were important. The interview schedule offered this opportunity, but also still reminded me of the topics I wanted to attend to (e.g. views on the website, views on the application process).

Reflecting on participant responses enabled me to adjust my approaches to the project, such as James' views on using agendas for our group gatherings and encouragement for my role to be more of a central coordinator. (These reflections are explored further in section 5.2.3.) Since James was leaving the project, the likelihood of omitting criticism to protect my feelings was reduced, and so this interview provided valuable insights into what was working in the project and how it could be improved. Thus, I could incorporate any changes within the ongoing Young SAGE project, rather than use these as personal development points within a future undertaking (similar to the benefits expressed for the continuation of the Youth Council in Richards-Schuster 2012: 91).

3.3.7 Ethics and informed consent

Due to the research design and the involvement of young participants, this research project was assessed at level 2 on the Moray House School of Education ethics scale: the likelihood of physical or emotional harm to the participants was minimal and consent was sought from participants. The main predicted sources of tensions were mainly around interaction-based issues (e.g. personality clashes), but nothing of this nature was noticed during the project. As a precaution, I paid attention to the advice of some groups (e.g. Shaw *et al.* 2011) and was aware of local youth organisations (e.g. 'The Junction' and 'Get the Lowdown'*)* in case issues were raised

by the participants that may have required external specialist support. From the perspective of child-protection issues, a Protection of Vulnerable Groups check was made through Disclosure Scotland in advance of the project starting, and I had experience of child-protection procedures and the potential for disclosures through my work in engaging young people through the SCI-FUN Roadshow project, and my prior primary-school teaching experience.

Audio recordings of the advisory group gatherings and semi-structured interviews were made throughout. To ensure data protection and confidentiality, these recordings were stored according to University of Edinburgh procedures (i.e. on a secure and backed-up network drive space). Due to the nature of the research, total anonymity could not be promised to participants, since they met each other during the course of the gatherings and their responsible adults had to counter-sign their application forms. Furthermore, I could not predict the exact nature of the project we would mould together. As it transpired, our plans to develop surveys and organise an event meant that teachers would be contacted by participants, and several participants were in contact with stall providers for the event. However, I have sought to maintain confidentiality within the outcomes of the research project. This has been achieved through a careful approach to reporting (such as this present thesis) to ensure specific identifiable characteristics are not included in any of these materials, including the use of quotes with pseudonyms (see Kustatscher 2015). I asked individuals to choose a pseudonym (Dockett *et al.* 2013) at the end of their involvement in the project, rather than from the outset, to reduce the potential for identification by other participants. Where no response to this request was received, I notified the participants of the pseudonym that I allocated on their behalf.

3.3.7.1 Responding to ethical tensions

Of course, during discussions with young people (or any project participant), disclosures of a potentially sensitive nature are possible, irrespective of the core

focus of the research (see Guillemin and Gillam 2004 for a stark example) – and so it proved in this project.

During the third group gathering, some of the participants discussed a recent incident where an acquaintance of some group members had become ill on a pizza after having a few drinks (also later termed "the puke story" when the group realised that the audio recording had captured the discussion). During this conversation, I did not ask about the circumstances under which this incident had happened, since the discussion seemed light-hearted and a parent was around at the time. However, there were two ethical conundrums that this story presented: firstly, were there any negative consequences for the individual at the heart of the puke story, and secondly, how to transcribe this discussion for my own reflections on the project and further reporting. For this second tension, I have removed all attributions, so that the identities of those involved in the original story cannot be identified, aligning with the guidance from Alderson and Morrow (2011b). However, the first tension caused greater reflection on my part:

> **The pizza story was told with more concern about the desire to eat pizza again […however…] I did email [the participant] who led telling the story to check on whether there are any concerns. It felt odd to do this mainly due to the fact that there wasn't much drink involved (in the opinion of others who were there) and also that the discussion in the gathering was so light-hearted. However, who knows what is going on and if there are other things occurring that could lead [the participant] to have some concerns which […s/he…] only considers after being prompted to reflect. That being said, I'd be very surprised if there were any unusual or serious issues. (Research diary, 28th Mar 2017)**

My reflection led me to question whether or not the puke story was really as inconsequential as I had originally assessed and I was therefore moved to contact the participant to ask whether there had been any longer-term ill-effects. Fortunately, the participant swiftly confirmed that there were no ongoing concerns. However, this episode neatly demonstrates that the course of free discussions can present ethically challenging moments for the researcher (Guillemin and Gillam

2004), even within topics of research into non-sensitive issues: such as within my research. How this puke-story example affected the balance between child protection and participant agency is explored in section 4.3.2.

Another key moment of ethical tension occurred during one of my introductory interviews. Within the first five minutes of our conversation, the participant revealed that their future project involvement could be affected by the illness of a close family member:

> **My reaction of [participant's] disclosure was intended to be neutral – hopefully it came through that way. In terms of the project, I commented that other things in life were more important, but didn't attempt to empathise or say anything consoling. This was due to avoiding a therapist-type role (as advised by Seidman 2006) and also I didn't want a tone of pity or sorrow to play a role in our discussion. [The participant] also shared the information very openly without appearing to show any emotion about the situation, so my instant reaction was that consolation was not an appropriate response anyway.**
>
> **During this part of our discussion, I also contemplated sharing my own experience of a parent passing away from cancer during my childhood, but decided not to as it didn't seem like information I ought to share on our first meeting and it could be seen as risking a therapy-style approach to the interaction. We didn't dwell on this disclosure for too long, but it would obviously be useful to listen back to the recording to better reflect on it. (Research diary, 22nd Nov 2016)**

This disclosure did take me by surprise, especially since it occurred so soon into our discussion. However, the composed manner of the participant, combined with my own similar experience, possibly helped me to appropriately process this disclosure. Acting in a consoling fashion would have been distracting and might not have helped to establish a collaborative research relationship. Listening back to the audio recording a few days later provided an opportunity to check my original impression:

> **The concern I felt after the disclosure of [participant] during the interview has reduced after listening back to the interview itself. [Participant] was not outwardly emotional when disclosing the information and I didn't treat the exchange as a therapy session. I**

think that the response was appropriate, and I hope that [the participant] does too. (Research diary, 27th Nov 2016)

This particular example illustrates that not only are audio recordings helpful for data analysis by capturing the precise words within discussions, but also enables original perceptions to be checked. Listening back to the original conversation, given the additional time this offered, enabled me to assess again whether or not I was acting in an ethically appropriate manner.

3.3.7.2 Combining procedural ethics with the participative nature of the research

Although the foundation of this research was assessed at level 2 of the Moray House School of Education ethics scale, the participative nature of the project meant that the precise project progression could not be described in advance, and therefore only the project's outline could be suitably assessed by the ethics committee initially (Appendix 9). Therefore, at three further moments (i.e. delivery of the survey for 16-18 year olds; delivery of pre-event surveys; and delivery of the event and post-event surveys), additional ethics applications were submitted for review in order to ensure that the Young SAGE group and I were undertaking our project in a suitable manner (Appendices 10, 11, and 12).

The complexity of participation-based research can cause tensions within ethics committees: for example, some members may prioritise participation rights over the need for protection (Daley 2015), and there can be apparent inconsistencies in decisions that ethics committees make (Powell and Smith 2009). Within my project, the nature of the final ethics application – covering the event organisation as well as the final survey – was challenging for the ethics committee members:

[The ethics committee] weren't sure whether [the event] was part of the research ethics or not. [A representative of the committee and I] had a discussion on the phone, and the result was that we agreed that the content of the event was not part of the research ethics, and therefore the application should be adjusted to reflect this. This interaction reflects the complexity around my current research

project: it has several layers to it. […] To be honest, I didn't think they needed to 'clear' the event, but they ought to be aware that the event is taking place as a direct result of the decisions taken by the Young SAGE participants. The ethics process therefore seems slightly unclear for participative research projects: it works well for [using] known and common research methods (e.g. surveys, interviews, and so on), but within a collaborative project, what is it that the ethics committee are focused on? I would argue that the development of the event is important, since this is part of my interactions with the group and some of this will be data for my research […] However, the content of the event doesn't require research ethics clearance to proceed, but it does require me to adhere to conventional practice, which I fortunately have through my regular job at the [University]. Being able to state [to the ethics committee representative] that the Insurance department at the University have confirmed we are covered by appropriate policies, and that [the Young SAGE group and I] are expecting to receive risk assessments from the stall providers, meant this provided more confidence to the ethics committee that the chances of reputational harm to the University from an adverse occurrence was reduced, but this was outside the scope of the research ethics considerations. (Research diary, 14th Feb 2018)

Ultimately, the ethics committee were focused on approving an application that specifically addressed the research methods that were being utilised to gather data: the post-event surveys and the suggestion box comments that would be provided by event attendees immediately after the event. The ethical considerations around event planning were perceived as part of my work-role and so the onus was on me as a public engagement practitioner (and not as PhD student) to act ethically by ensuring health and safety guidance was followed (e.g. stall-holders had to provide risk assessments). Additionally, if disclosures were made during the event, I was there to address these in a suitable manner. That being said, I was uncomfortable removing all event-related considerations (like health and safety practicalities) from the ethics application form – since I perceived this should be an element of ensuring participant safety (Daley 2015) – and I therefore retained these reflections in distinct 'for information' sections. It was fortunate that I had event-planning experience within the University context, since this provided confidence to the ethics committee that I could appropriately support the event despite this not being part of the ethics committee focus. Making distinctions between the event and the

research was challenging, since the event was completely intertwined with the research from my perspective.

3.3.7.3 Informed consent throughout a participative research project

At the heart of participation – being freely involved in a project or process – is the notion of informed consent. It is argued that informed consent is only possible if the potential participants have received the correct information about a project and have understood it (Fargas-Malet *et al.* 2010). As a result, I developed an information/application form (Appendix 2) to introduce myself, provide an overview of the project's ethos, discuss confidentiality issues, and make clear that participants could change their mind about being involved at any point. In an attempt to communicate more effectively with the target age-range of upper secondary school pupils (Dockett *et al.* 2013), I used a question-and-answer style using clear, active language in order to make the focus of each section more obvious. I put a priority on seeking the consent of young people who were interested by sharing information about the project through schools first. However, it is considered best practice for the consent of a responsible adult to be sought as well for young people under 18 (Kirby 2004). Therefore, I also requested consent from a responsible adult, but by positioning the name/signature of the young person on the left of the application form, and the name/signature of the responsible adult on the right, I implicitly indicated that the consent of the young people was of greater importance: the adult was merely endorsing the young person's choice.

As previously described, due to the collaborative ethos and developing the project alongside participants, I could not provide specific details in the information form beyond the overall aim of exploring young people's science experiences. Due to being unable to provide precise details in advance, some researchers argue that open, collaborative research is incompatible with the notion of informed consent, but as Alderson and Morrow (2011a) reflect, the true nature of informed consent is

about respect for project participants, and that research of a more explorative nature enhances that respect by including and involving participants in research decisions. Nevertheless, I included a list of potential ideas (ensuring these were offered as possibilities and not certainties), so that prospective participants would have an appreciation of the sort of activities they could be getting involved with. Furthermore, the introductory interviews provided an opportunity for participants to seek clarity about the project if they wished. Of the questions they asked, most were about the other participants (i.e. number of participants, age range) and some practical aspects (i.e. duration of project, frequency of gatherings). Interestingly, given the lack of precise project steps in the information form, Laura asked explicitly about the overall purpose of the project within her introductory interview:

> **Laura: Will you be like writing a paper at the end of it or is that, what's going to happen at the end, like what's the end goal?**
>
> **Stuart: […] I suppose I have two, two pulls on me: there's one where I'm doing this as a PhD project, so I have to do a giant document at the end with all sorts of stuff in it […] In terms of the group and what we do, I don't want to say "This is what we're going to do," because I think that will totally undermine the purpose […] hopefully quite quickly [we'll] identify the sorts of things we want to focus on. […] But I don't want to say "This is where I want us to go to…" because it depends on the initial ideas we want to focus on… (Laura interview, 18th Nov 2016)**

This was a challenging question to adequately respond to, since there was a risk of being too directive in how the project could progress. In response to Laura's interest in my project goals, to which I briefly provided an overview of the PhD process (thus suggesting the existance of different goals for the project, see Lohmeyer 2019), I intentionally shifted the focus onto the potential goals for the group and my desire to work collaboratively and avoid a pre-determined aim. It was understandable that Laura wanted further details, and – from the perspective of informed consent – it would have been unsuitable for me to withhold these, but further details did not exist in advance of the collaboration.

Within my long-term collaborative project, the ongoing engagement of participants was a straightforward indication of their continuing consent. However, to adhere to the ethos of informed consent, participants were aware that they could withdraw at any point through the information/consent form (Kirby 2004) and four individuals formally did so at different times. Although they did not need to provide explanations, they did: one withdrew before the first group gathering and one in March 2018, both of whom cited reasons related to schoolwork, and a further two left the project during the summer of 2017 (approximately six months into the group gathering phase) due to leaving the city after their school studies. In addition to these four, another suspended their involvement due to family-related issues, whilst another participant stopped replying to Young SAGE messages. Furthermore, participants could consent to be involved in individual group gatherings: a Doodle-poll approach (described in further detail in chapter 5) enabled the identification of gathering dates that suited the majority, and then individuals would confirm their attendance.

Finally, the consideration of informed consent became part of the collaborative project itself, during which several surveys were developed for groups of pupils within the schools of the Young SAGE team. The first survey was intended for completion by senior pupils (Appendix 13), and the participants considered that after a brief introduction it was important to make explicit that those reading the form knew they had a choice in whether or not they responded to the questions:

> **Just a few details to get an idea of who you are. You are under no obligation to give out these details or complete this survey if you aren't comfortable with giving out such information. (hence the "Prefer not to say" options.) (Quoted from the original version of the survey for senior pupils).**

In this way, we decided that the choice for potential respondents in providing their views was clear, and the completion of the form would indicate consent. However, after review by the ethics committee, we then included a more explicit yes/no

question for consent immediately after the survey introduction. According to Andres (2012a), our original position of assumed consent through the act of responding to the questions was reasonable, but we should have also reminded potential respondents that any submission of answers would be assumed to imply consent for their data to be used within our project. The guidance of the ethics committee to ask an explicit question was arguably more than required, and it did provide a slight issue for responses where all questions were answered, but the answer to the explicit consent question was “no”. When this happened, we removed these surveys (and their data) from consideration.

3.4 Analysing the data

Within this section I describe and reflect on my steps to move from data gathering and towards the development of my research findings through a thematic analysis approach based on the constant comparison method (Braun and Clarke 2006).

3.4.1 Transcribing interviews and gatherings

Alongside my research diary and jotted notes from the group gatherings, I had a significant amount of audio recordings from the interviews undertaken with the project participants as well as the group gatherings. I made full transcriptions of the introductory interviews as well as the first five group gatherings. Although time-consuming, I undertook these transcriptions myself as I could use my contextual knowledge to better recognise what was said when statements were unclear, add my initial analytical notes, and review my own interviewing technique for potential improvements (Krueger and Casey 2015, Padgett 2017).

After transferring recordings to my computer, I used Dragon 12 voice recognition software following the advice of Krueger and Casey (2015: 151) to speed up the transcription process. I used keyboard short-cut buttons to play/pause the recording and I repeated what was said during the interviews so that the software could recognise my voice and transcribe. Once this initial rough transcription was

complete, I listened to the full recording again to check that the transcribed version was faithful to what was actually said. It took approximately 7-8 hours to completely transcribe an hour of individual interview and 8-9 hours for an hour of a group gathering. To help provide a visual distinction in the transcriptions, my words were in regular font, while participant comments were in bold. For the gatherings, comments were attributed to individuals; over time, I recognised the voices of the majority of participants fairly well, but a sketch of the seating layout in my jotted notes (Emerson *et al.* 2001) – alongside digital voice recordings – helped to locate the individual and confirm who made each comment.

For the remaining group gatherings, I only transcribed sections that I suspected could further contribute to the developing analytical themes. This type of "abridged transcript" (Krueger and Casey 2015: 149) does not only reduce the time for transcription, but it is an active part of the analysis process: sections that are judged to be irrelevant to the formal analysis process are removed. In this way, my act of transcription was not just a process of transferring the spoken word to written text, but the beginning of my analytical journey.

This process of transcription itself is not without its issues: it has been called "…a time-consuming ordeal…" (Krueger and Casey 2015: 150) and requires "…intense labour…" (Padgett 2017: 147), but these descriptions do not adequately cover the challenge of the transcription act in any way. Although I naively thought transcribing would be a straightforward process, the time that transcriptions took was only one issue; there were three further challenges. Firstly, I was not always successful in repeating the exact words that were originally spoken in the recordings, and on many occasions, I had to edit entire phrases when checking the initial rough transcription. Secondly, the voice recognition software had to be trained to my voice, and was not completely reliable in replicating what I had said. Thirdly, the task was mind-numbingly tedious: the action of listening and repeating, and keeping my concentration, was more difficult than I had originally imagined. At first, I attempted to check the transcription provided by the software immediately

after uttering each phrase, but I found this not only slowed down the process, but heightened my feelings of frustration towards the process and I did not catch all of the transcription errors anyway. My approach of a rough transcription followed by a complete re-listen and correction was the best compromise overall. Corrections of transcriptions are necessary even for professionally produced transcriptions (Padgett 2017), so using a transcription service would not have completely remedied the issue and would have reduced my familiarity with the data, which was important for my initial analysis.

3.4.2 Producing codes and themes through thematic analysis

After my transcription, the constant comparative method was at the heart of my thematic analysis approach which, based on Braun and Clarke (2006) and Thomas (2013) involved:

- being immersed in the data;
- coding to produce first-stage ideas;
- reviewing data with the first set of codes to produce the main constructs;
- refining these constructs if required to produce themes;
- exploring the themes and seeing how they connect and interrelate (i.e. network analysis); and finally,
- selecting quotes or passages to represent the themes.

The above approach was first suggested for critical theorists, but it is now argued to be at the heart of most qualitative-based research studies (Thomas 2013) through its focus on the data and the connections between them (Padgett 2017). Although not always recognised as an important part of the process (e.g. Houghton *et al.* 2015), the immersion in the data corpus is an invaluable first step: being aware of the participants' views and opinions through my presence in interviews and group gatherings, and enhancing this awareness through the transcription process, enabled me to recognise what might become important when starting to code. The

process of immersion was not a merely passive act, but the beginning of my appreciation of the data and the foundation of my analysis.

The constant comparative method was employed as part of a thematic analysis approach (Braun and Clarke 2006). In contrast to some analytic approaches, it is argued that thematic analysis offers a flexible basis (Braun and Clarke 2006) and "…has an all-purpose quality that make its adoption or uptake by more formalized approaches relatively easy" (Padgett 2017: 152). Other analytical approaches – such as narrative analysis and discourse analysis – would have been unsuitable for the case study approach adopted in this study, principally due to the nature of my research questions. Narrative analysis, for example, looks within a data item (e.g. a single interview) rather than across the whole data set (Braun and Clarke 2006), and therefore failed to meet my requirement to explore viewpoints through different data collection methods. The explicit focus on the use of language in social situations offered by discourse analysis (Thomas 2013) was not appropriate either: the precise words participants chose to say did not completely reveal wider concepts (but some words – such as conjunctions – potentially signalled explanations for particular views). Therefore, the flexibility inherent in thematic analysis provided the most suitable approach for my study, as it enabled a focus on the different ideas – and therefore themes – which arose during the project.

A further important analytical decision centred on the level at which the discourse was approached. Since I am not a young person, when coding it did not seem appropriate to initially look beyond the semantic (surface) level of the participants' language (Braun and Clarke 2006). If I approached the data by immediately trying to understand latent (deeper-level) ideas, my interpretation might have inadvertently altered the intended viewpoint of the participants. This risk of distortion is recognised by other novice researchers (e.g. Gadda 2012). Therefore, through a semantic coding process, the ideas expressed by the young participants were retained to a greater extent, although my choice of codes still had an element of

interpretation, despite some writers claiming that interpretation only begins from the confirmation of themes (Braun and Clarke 2006).

Since the principal aim of my study was an exploration of ideas, it was necessary for codes to be inductively generated within the constant comparative method. Initially, the detection of repetitions, similarities and differences (Ryan and Bernard 2003) were the most important techniques for the initial coding stages. I had considered that the use of colloquial terms (known as "Indigenous typologies or categories" by Ryan and Bernard 2003: 89) which young people often use might have presented opportunities for coding, but this did not transpire during the project (perhaps due to participants using such terms less frequently in our intergenerational context in comparison with their regular conversations). Within thematic analysis, the judgement and values of the researcher in the process of analysis is embraced (Braun and Clarke 2006), which again aligned with my foundation of this project. For example, there was no quantitative threshold for when a code was considered important enough to become a theme, which itself can be defined as: "…something important about the data in relation to the research question, and represents some level of *patterned* response or meaning within the data set" (Braun and Clarke 2006: 83; original emphasis). Therefore, the journey from initial codes to the development of themes depended on my decisions regarding what I considered relevant enough to respond to the research questions. A view could have been expressed multiple times, but equally a single comment may have offered an insightful counter-point to a more commonly repeated idea.

To become more familiar with my data, I chose to initially code transcripts using a pen and paper approach (see Ryan and Bernard 2003). Although I later used NVivo, I first wanted to become accustomed with the process of looking at the data and identifying excerpts relevant for my research questions and not be concurrently distracted by becoming familiar with the software. Within the interviews, my choice of questions occasionally simplified the identification of relevant excerpts: for example, the question "Can you take me through experience A [given by

participant] with as much detail as you want to provide?" mainly produced responses related to my research questions focused on science experiences. Using the pen-and-paper technique, I was able to start developing some nascent codes and references to where the data appeared in the transcripts. Once I had gone through the individual interviews, I then attempted to code these same excerpts of interest within the NVivo software in order to: utilise the capability to code excerpts in multiple ways; be able to quickly see a coded excerpt back in its original context; and quickly gain a sense of the excerpts within each code (Bazeley 2013). However, the transfer of my excerpts of interest to NVivo was not straightforward, since:

> **…the NVivo files do not have the page numbers when the transcriptions have been imported into the project. Therefore, I have recoded and then looked back at my provisional sheets of 'mind mapped' codes to check on the overlap. Mostly, I have captured the same areas of interest as I did the first time. The main exception was an issue in science experiences that Megan touched on […] This omission was probably due to writing the overall theme as Negative Science Experiences and not as Issues in Science Experiences: Megan doesn't really discuss a negative experience, but does convey a problem with school-based teaching of science. (Research diary, 22nd Oct 2017)**

Although the lack of page numbers in the NVivo interface caused a practical issue, this situation was a useful opportunity to scrutinise my own coding, as I had to recode the transcripts from scratch. Mostly, my coding was along the same lines, but, as seen in the above excerpt, there were some tensions, which enabled reflection on the appropriateness of my initial attempts. These tensions were overcome by adjusting the code-tree, which assisted the progression from the first-stage codes to the main constructs, and the later identification of themes (Braun and Clarke 2006, Thomas 2013).

After developing themes, I explored how they interrelated. A network analysis – the connection of themes and sub-themes – enabled a construction that illuminated how the different themes linked with each other (Thomas 2013) across the whole data corpus, instead of a construct mapping approach (Thomas 2013) that focuses

on themes within a single data item. Although the overall analysis process has been described in a fairly linear manner here, it actually required recursive steps (Braun and Clarke 2006, Thomas 2011a): for example, to check whether the most appropriate decisions had been made with respect to codes and themes, and whether these needed to be adjusted (like in the "negative science experiences" excerpt above). Therefore, an adjusted inductive approach was actually utilised in the development of codes and themes: an initial data-driven, inductive phase was utilised to identify initial themes, which were then revised as further data were coded and analysed.

3.4.3 Attending to rigour and generalisability within a practitioner case study

The rigour of case study research is greatly questioned within the literature, with many proponents of the approach often stating it is deemed weaker than other methodologies due to perceived limits in its (statistical) generalisability (Flyvbjerg 2006, Thomas 2011a, Miles 2015, Yazan 2015), and that some researchers only consider it useful at the initial exploratory stages of wider research projects (Yin 2014). Furthermore, within the qualitative tradition, there is particular debate over the merits of terms such as validity, reliability and generalisability and whether equivalent terms such as plausibility and credibility should be employed instead. A summary of some of these key terms is presented in the following table:

Qualitative-associated	**Quantitative-associated**
Credibility: How well does the data represent the situation? (Morse 2015) This involves value-based judgements of the researcher as well as the reader.	**Validity (internal)**: The extent to which findings accurately describe or reflect the phenomenon in question (Bush 2012). The degree to which the overall project finds out what the researcher intends to find out (Thomas 2011a). This prioritises a value-free researcher position.

Qualitative-associated	Quantitative-associated
Plausibility: A value-based judgement from the report audience. How the accepted likeliness of how the findings fit with the worldview of the reader (Thomas 2011a).	**Reliability**: The degree to which the replicability of results from a method or procedure is possible (Thomas 2013); increasing reliability may compromise validity, especially if considered within qualitative studies (Bush 2012).
Analytical generalisability: A researcher-based articulation of the extent to which the research findings apply to a domain beyond the specific study boundaries (Yin 2014).	**Statistical generalisability**: Also known as external validity (Guba and Lincoln 1994), this is the relationship between the research findings and the wider population (Bush 2012) to which a statistical sample relates.
Triangulation: Has different meanings dependent on the epistemological view of the researcher: can either be concerned with checking findings through different methods or data sources, or it is focused on alternative understandings and the origins of these (Hammersley 2008).	
Rigour: The use of appropriate procedures and being thorough with time and attention to detail in order to obtain data and support research claims; transparency around data collection and analysis is important (Tracy 2010).	

Figure 6: Key terms associated with research rigour and generalisability

The debate continues over the above key terms as they relate to different foundations of research. As such, in an attempt to bring together different research traditions, Morse (2015) presents an innovative – yet problematic – argument for using the terms validity, reliability and generalisability as standard throughout all qualitative and quantitative research. By having standard definitions for these terms, Morse (2015) contends that this would enable scholarly discussion throughout all forms of inquiry to have the same foundation. Unfortunately, using these terms throughout the whole of the research landscape could result in even greater confusion. From my own background in the natural sciences, I associate validity, reliability and generalisability with the positivistic nature of a value-free researcher. For example, within quantitative research the idea of (internal) validity is usually associated with how well the effect of other confounding factors have been reduced, enabling a causative link to be established between the variable of

interest and the observed outcome (see Scott and Morrison 2006). Within my case study research, the notion of internal validity was an unsuitable concept: I did not seek to reduce my case to an exploration of a single factor and the implications of changing this. I was dealing with a variety of perspectives from young people towards my main research questions in a more exploratory fashion. Therefore, it does not seem beneficial to have a standard terminology that is applied in non-identical fashions across the quantitative and qualitative traditions.

Within my research, it was more appropriate to consider the quality of the data within the case and how to demonstrate how this data was rigorous. My focus on the data aligns with the notion of credibility (or quality) which results from an open interaction between all involved in the research and allows for the construction of a mutually agreeable and authentic set of conclusions (Lincoln *et al.* 2011). The concept of credibility was an important consideration in my research. I worked with a group of young people for a significant period of time and needed to create an ethos where we would be undertaking a genuine collaboration within which all views could contribute to the evolution of the group's plans.

Related to the idea of credibility is the notion of triangulation. For my case, this was conceived as permitting explorations of apparent inconsistencies revealed by different methods in order to enhance understandings: "Finding such inconsistencies ought not be viewed as weakening the credibility of results, but rather as offering opportunities for deeper insight into the relationship between inquiry approach and the phenomenon under study" (Patton 1999: 1193). Similarly, based on Cicourel, Hammersley (2008) describes indefinite triangulation, an approach that embraces multiple perspectives on the same event and focuses on why people have different understandings and from where these originate. Following the conceptualisations of Patton (1999) and Hammersley (2008), I chose to make value-based judgements within the comparison of findings that arose throughout the data collected. By making these judgements, I risked interpreting perspectives as being supportive or contradictory when the opposite could be the

reality or there could be no connection at all. In these circumstances, I sought clarification through returning to the data, as well as asking the participants for further views through our regular group gatherings.

Due to the inherent variability of qualitative research, from the contexts in which it takes place through to the methods employed, some researchers contend that there cannot be common standards for the validity of qualitative research, but instead others should choose to accept or reject the presented evidence depending on their own judgements (Freeman *et al.* 2007). This view aligns with the idea of plausibility: the judgement of the reader on a study's findings based on their own perspective. Alongside credibility, the notion of plausibility within my study supports the view of Thomas (2011a), and together these dimensions around performing quality research combine to form the basis of demonstrating rigour throughout. In sum, the aim for my research was to incorporate the genuine perspectives of my participants through the case study approach.

Based on Yin's (2014) idea of analytical generalisation, I offer my perspective on how my findings can apply to other contexts. However, the perspectives of others within other contexts are also important in assessing the credibility of my findings for alternative circumstances. Therefore, within this thesis I present actual examples from my experience of working with a young person advisory group, along with the context of this research, in order to assist others in the work or research they are undertaking (see Thomas 2011a). I do not claim to provide any universal theories, but – in the manner of Flyvbjerg (2006) – I openly invite others within different contexts to consider this research and assess the suitability of the findings for their different situations and experiences. For my study, offering knowledge for others to make their own judgements for the transferability to their own contexts is a realistic goal; the diversity of childhoods described in the literature review provides further justification for why a nomothetic output cannot be obtained and should not be expected.

3.5 Limitations of the research: diversity and generalisability

From the outset, in response to Punch (2019), I was focused on addressing the marginalisation of young people's voices. This goal influenced my recruitment priority: I had to reach young people who were genuinely motivated to participate, since they had to freely consent to be part of an open-ended explorative project. There are a variety of intrinsic and altruistic motivations for people to become involved in any research project (Clark 2010). Drawing on the research of others, Hill (2006) summarises the motivations of young people to participate as: having an interest in the topic; extending their own learning; discussing their own issues to seek solutions; being empowered through expressing views; having a new experience; and wanting to achieve change and improve things for others. The exploration of ideas here is key: my project had a general aim and relied on motivated participants who would persist with the project alongside their other priorities.

Consequently, my intergenerational focus meant that the characteristics of potential participants and influences resulting from other social orders (e.g. gender, race, etc.) was of less importance; a position discussed in section 2.3.3.2. (However, this means there are opportunities for future research to expand on my work by attending to other social orders.) Therefore, as with other projects involving a relatively small number of participants (e.g. Kyristi 2018), I wish to avoid compromising confidentiality by providing a detailed participant list. My commitment also extends to what Tolich (2004: 101) describes as "internal confidentiality": the possibility for other study participants to identify individuals despite the use of pseudonyms.

Thus, I describe only some general aspects of the participants here. Over the course of the project, 13 young people (16-18 years old) were involved in Young SAGE. In their application forms: eight identified as female, and five as male; 12 stated they were White British, with one identifying as Other. Through our discussions during the project, two of the White British participants revealed they had parents from

other European nations; one participant was American with Iranian heritage. Furthermore, again based on details shared through our conversations, most participants seemed to come from middle-class families, with perhaps two to four being from working-class backgrounds.

The predominantly white ethnicities of the participants will have played a role in their experiences of science. For example, there was a generally positive disposition within the group towards the accessibility of science festivals and museums (see section 6.1.2), contrasting with research elsewhere that finds museum spaces are regarded as inaccessible for many people from minority ethnic backgrounds (see DeWitt and Archer 2017, Dawson 2018). In addition, it was clear that all participants had existing science interests, had ambitions for further study related to science (not all at university-level though), and attended schools where higher proportions of pupils left for positive destinations (e.g. further education, work, or training within six months of leaving school) relative to the city average. These factors – especially participants' preparations for leaving school – may have been influential on participants' immediate priorities around science.

However, participants did not have completely identical backgrounds and perspectives: some parents worked in science, some did not; some participants lived with one of their parents, whilst others lived with both; some participants were more interested in competitive experiences than others; some participants had part-time work (or began working during the project) and others did not; and some participants played musical instruments, whilst others had other hobbies including reading, cooking, and playing sports. In terms of future ambitions, all participants seemed to have an interest in science, but these interests included diverse topics such as astrophysics, environmental sciences, pharmacology, medicine, and architecture.

At a surface level, the participants seem quite similar to each other, but this ignores the various disciplines that the term 'science' covers. That being said, my research findings are an initial exploration, and future work should explore the influences of

other social orders (e.g. race, gender, ethnicity, etc.). In addition, seeking further insights from young people attending schools with lower rates of positive destinations for their leavers may reveal whether the learning environment of young people influences their views around engagement with science. Furthermore, seeking perspectives from individuals who are not studying any sciences, or not in formal education, as well as engaging different age groups, would assist in seeing how plausible my research findings are to other contexts.

3.6 Conclusion

In this chapter I have discussed my pragmatic considerations in developing a co-production approach (see section 2.4.2) that enabled young participants and myself to work collaboratively. I have justified the development of a case study structure (Yazan 2015) that offered appropriate flexibility to maintain the collaborative foundation I sought. By reflecting on Åkerström *et al.* (2015), through the idea of power being exchanged within actions and reactions (Foucault 1980, Gallagher 2008), I illustrated how the researcher can negatively impact on the capacity for collaboration, thus highlighting the pitfalls that I aimed to avoid through a reflexive mindset.

To construct my case study, a variety of methods were employed as data-sources. My research diary (Burgess 1981, Thomas 2011a) enabled a chronological record (Okely 2002) of the research to be maintained, facilitated my initial analysis, and enabled further reflection on my experiences. Semi-structured introductory interviews assisted the development of rapport with participants, while our group gatherings progressed from bearing the hallmarks of group interviews towards the start – with me being central to all discussions – to later being more akin to collaborative conversations. How this progression took place is core to my analysis of intergenerational working presented in chapters 4 and 5.

During the project, ethical dimensions gave rise to challenging moments for my interactions with participants (Guillemin and Gillam 2004), and I have also critiqued

formal ethics committee procedures (Daley 2015), which illustrate the contrast between protection of research participants and providing space for participation. Where the former positions participants as vulnerable, the latter supports the active agency of those involved. Within a context where I could not precisely define in advance how the project would progress in a project involving young people, the marginalised status of young people reinforced the need to minimise risk for my participants.

Finally, after highlighting the challenging nature of transcription (Krueger and Casey 2015, Padgett 2017), this chapter has offered a detailed overview of my analytic approach (Braun and Clarke 2006, Thomas 2013) and supported my initial attention to the semantic level of participants' words in order to avoid pre-emptively distorting their possible meanings. In the following chapters, and based on these careful considerations, I have therefore developed my findings associated with the challenges for the adult researcher; ownership within intergenerational working; and young people's perspectives on public engagement with science.

4 Challenges for the adult in an intergenerational research project

Although there has been significant progress in making the case for participation within both childhood studies (e.g. Prout and James 1997, Tisdall *et al.* 2008) and public engagement with science (e.g. Wynne 1995, Sturgis 2014) fields in enhancing the development of knowledge, further attention is needed on the power relationships at the heart of intergenerational collaborations involving young people (Gallagher 2008). In particular, when considering the real-life practicalities of reducing the adult researcher's control over an intergenerational collaboration (Wyness 2013), there is currently a lack of explicit focus on how the adult researcher is constrained by external commitments, as well as other influences on their role. For my research, the constraints resulted from my adult status, as well as my professional work reputation, and the ethical responsibilities demanded by my researcher status.

Thus, in this chapter, I first draw attention to my markers of difference and show how these markers contributed to my different status in the group, countering the idea that a 'least-adult' role (Mandell 1988, see also Spyrou 2011) is possible for adult researchers in this context. Then, I explore how my own contextual influences were brought to bear as the research developed (see Greenbank 2003): for example, my concerns around the complexity of the group's plans due to my event-management experience. Finally, I turn to examples of specific conflicts within my project commitments, such as how my drive to recognise participant agency was displaced by my child-protection responsibilities (see Nolas 2015).

4.1 Markers of difference: the adult researcher's unique role

In this section I discuss how my role in the project was distinct in comparison with the Young SAGE participants. Initially, I focus on my own practical project responsibilities and how these contributed to my difference in relation to the young

participants. Then, I explore how others – the participants and other adults who were engaged – acted in ways that conferred a distinct status on me within the Young SAGE collaboration. Where relevant, I reflect on my own actions and reactions and how these emphasised my difference and influenced the power dynamics of the group's interactions.

4.1.1 Practical group coordination

As a consequence of bringing the group together, I felt a responsibility to lead the initial project coordination, for example by convening group gatherings. However, I was concerned that this central group role would contribute towards uneven power dynamics between myself and the participants:

> **So far 7 of 10 participants have responded to the Doodle poll with the Sundays again the most likely options […there is…] some pressure on the remaining three to offer their availabilities or otherwise. It's a tricky balance: I don't want it to be an uneven relationship with the participants, but at this stage, because it is still seen as my project and I am the only one able to communicate with everyone, the onus is on me to make the arrangements and 'hassle' non-responders. Having alternative, and ethical, communication channels would be advantageous in offering the chance for more dialogue between the participants and not have me in the position of constantly driving this. Of course, I may still have to [,] to a certain degree, but the dynamic may shift over time, just like the interactions within the gatherings have already led to greater discussion between the participants and some promising signs in making suggestions for the nature of the future gatherings. (Research diary, 13th Feb 2017)**

This excerpt reflects my concern, based on comments from some participants in referring to the project as belonging to me. Towards the end of the first gathering, for example, Luis asked what I was looking to achieve by the end of the project, aligning with the marginalised position of young people (relative to the normative powerful position of adults) in Minority World societies (Punch 2002b). Instead of having a specific end goal – which was what I interpreted Luis' question to mean – I was aiming for a collaboration where we would all define together what we wanted to achieve; this aim was shared with participants in our earlier introductory

interviews. Therefore, Luis' question suggested that I still needed to reinforce my collaborative intent to mitigate this generational divide (Mayall 2000).

Furthermore, within the previous excerpt I reflected on the restricted communication channels: no one else was in contact with all of the participants apart from me (at this stage of the project), which made it difficult for anyone else to make gathering arrangements. Still, I wanted to include participants in decision-making through an online poll (i.e. Doodle[24]) within which participants indicated their availabilities. My approach contrasted with some researchers, such as Åkerström and Brunnberg (2013), who independently fix their participant meetings dates to establish a known schedule. (In his exit interview, Luis suggested his preference for fixed dates, but also admitted his attendance would not have improved due to conflicting events.) However, by deciding on dates without participants' views, the researcher undermines any collaborative intent by implicitly elevating the research project above participants' other priorities: e.g. work shifts; school-related tasks; and home-life responsibilities. Although negotiating arrangements is more straightforward for individual interviews (Mawn *et al.* 2016), researchers working with groups should also be flexible around participant priorities (see also Kirby 2004), since independently setting fixed dates is incompatible with collaborative values.

It seemed participants were content with me undertaking this coordinating role, and I also regarded this positively since participants could focus on the content of the project itself, rather than spending time on administration of the group gatherings (aligning with the advice of Kirby 2004), that would be of minimal benefit. However, I had to scrutinise my actions to reduce the risk of taking over, as this research diary extract shortly prior to the fourth gathering suggests:

> **…but I'll need to be aware that my apparent responsibility in organising the group does not develop into responsibility for the actual content of the group's decisions. For example, I should have a contribution into the decision-making process – such as questioning**

[24] https://doodle.com/

> **the group on their chosen topics and approaches – but I shouldn't lead on the decisions made. At this stage, I'm confident that the group is open to working in this fashion, but I'll need to be reflexive to reduce the possibility of an overly influential position. (Research diary, 21st Apr 2017)**

Here, I was aiming to engage with the decision-making processes of the group, but did not want to dominate and lead this aspect of our work. With this specific intention, I believe I was reasonably successful, especially since the group appeared happy with my role for the Young SAGE event, which is discussed in section 4.2.2, although the distinction between coordination and taking decisions was arguably less clear with respect to this organisation.

My discomfort in coordinating arrangements extended to my insistence on securing confirmations from participants for attending upcoming gatherings. Flexible schedules (as we had within the Young SAGE project) are argued to relieve pressures on participants (Ruiz-Mallén *et al.* 2016), who clearly have lives beyond the research context (Kellett 2005, Wilkinson and Wilkinson 2018). However, the process of confirming dates for Young SAGE gatherings made me feel I could still be pressurising individuals. In my many work-based interactions with adults, I have never felt concerned that I was emailing too often and therefore pressurising them. As Shier suggests, "…in practice adults are more likely to deny children developmentally appropriate degrees of responsibility than to force too much responsibility on them" (2001: 115). As I did not want to pressurise participants, I rarely phoned them unless I decided that a rapid response was needed, such as for child-protection reasons (see 4.3.2).

Even though participants recognised the unique coordination role caused by the above dimensions, describing my precise status was not straightforward, as this discussion ensuing from potential communication options towards the start of the project illustrates:

> **Megan: It's technically like you [Stuart] being the, don't know what to call you, you're not really a teacher! [General laughter]**

Stuart: No I am not!

[Several overlapping comments]

James: Group administrator.

Stuart: Administrator. That's administrator, yeah! [Whispering]: Not Head of the Group!

Megan: But administrators can have multiple meanings! (2nd Young SAGE gathering, 5th Feb 2017)

Megan's assessment that I was not 'really a teacher' is complex in whether this was a positive or negative statement given my aim to avoid a leading role in the operation of the group. Methodology research into gaining views from children and young people suggests that adult researchers in school-based environments can be equated to teachers depending on how they physically locate themselves (Hill 2006). If the adult researcher stands at the front of the class, then they could be treated as a teacher and offer the impression that there are correct answers to any questions posed (Fargas-Malet *et al.* 2010). Although I attempted to place myself alongside participants as much as possible (e.g. sitting around the table with participants), and aimed to resist being in sole charge, Megan's statement in this excerpt may have reflected her recognition that I shared some teacher-characteristics. I was an adult working with young people and perhaps retained some behaviours from my previous teaching experience, but also – and more positively – I perhaps did not completely act like a teacher; I did not seek to overly direct the activities of the group nor discipline the participants in any way. Additionally, despite not holding Young SAGE gatherings in schools, the university locations could have contributed to a teacher-learner dynamic with which participants were familiar. Finally, this excerpt also demonstrates the participants' difficulty in articulating my specific role. After James suggested 'administrator', and I agreed, Megan was still uncertain that this adequately described my position in the group. This ambiguity illustrates that despite coordinating the practicalities of the group gatherings, I was successfully avoiding the possibility for participants to assume that I was the powerful adult in charge (Mayall 2000, Spyrou 2011).

However, this ambiguity may have also contributed to uncertainties in the ownership of different project facets, uncertainties that are explored further in chapter 5.

4.1.2 Mental and practical gathering preparations

Further to my Young SAGE coordination role, I had specific practical markers of difference within the gatherings themselves. For example, I had to submit my ethics application prior to commencing the research process, which required me to convince more experienced researchers that I had adequately considered the more obvious potential tensions in my work (Guillemin and Gillam 2004). More specifically, resonating with advice from focus-group researchers in preparing myself to support the development of participants' ideas (Gibson 2012), I drafted a gathering 'schedule' (Appendix 14) – my prediction of prioritised topics for the gathering that were occasionally discussed at the end of the previous gathering – and I usually arrived an hour before the participants to setup and order the food (unless we were going to a café; Appendix 15). These actions helped me feel more prepared for the gatherings, in a similar way to Fox's (2013) approach in her research with young people excluded from school. However, this preparation set me mentally apart from the participants, even if this preparation did not have a direct effect on the participants' attitudes or behaviours.

Furthermore, I had physical objects that reflected my different status during the gatherings: I used a digital voice recorder and I had my jottings book in which I noted comments of potential interest, as well as seating arrangements to assist my transcription process. However, despite the recorder and book being in plain sight throughout our discussions, participants seemed blind to these physical signs of difference:

> **Stuart: Any final comments before I turn the recorder off?**
>
> **Helen: Oh!**

Stuart: Yeah, I still haven't turned the recorder off!

Megan: It's been recording this whole time?

Stuart: The whole conversation! [Some group laughter]

Megan: Even us talking about, you know, the puke story?

Stuart: Yeah! That's in there! That's going to be a good one to type up!

[Overlapping comments]

Lisa: It wasn't about us, we were fine.

Alissa: I'm sorry for you having to listen to this again!

Emma: You have to listen to this again?!

Helen: Just writing all this stuff up would give me nightmares! [General laughter] (3rd Young SAGE gathering, 19th Mar 2017)

Despite my earlier statements about the recorder and its position in the middle of the group, the reaction of Helen and Megan suggests that after a period of time, some markers of difference can become overlooked: they are not consciously noticed and may not directly affect group interactions (although I still needed to check that the recorder was working). Despite this participant oversight, I was still different to the participants: Alissa seemed delighted that she did not have to do anything with the recording (unlike my need to transcribe the discussions), a view enthusiastically endorsed by Helen's 'nightmare' claim shortly afterwards.

Throughout the course of our interactions, none of the participants appeared to be interested in taking on coordination roles. In Kirby's (2004) guide to involving young people in research, she advises adult researchers to be flexible and negotiate levels of involvement within various aspects of the project as these will appeal differently to different participants. For Young SAGE, participants could have been content with a normative adult-young person dynamic, concluding that coordinating all aspects of the gatherings should remain my responsibility, since they were the format I had proposed. In this light, it is noteworthy that Megan attempted to arrange a gathering close to the time of the Young SAGE event over a weekend I

was unavailable. However, this attempt was unsuccessful, possibly due to the short notice period within which other participants would have had to respond. Although a marker of difference, the actions within Young SAGE raise the idea that the adult coordinator in intergenerational research possibly has a more straightforward task in making arrangements for gatherings in comparison with younger participants, but also this could risk the extent of the collaborative intentions of the adult researcher.

4.1.3 Acting as a sounding board for participants

As the project progressed, I increasingly sought to pose questions to softly challenge group discussions and help the project's development without taking a directive tone. In response, participants treated me differently to the rest of the group by asking me specific questions, either within group gatherings or by email, which seemed to cast my identities as a university-employee and/or an adult in a more privileged position in comparison with their subsequently less privileged identities as young people. One example occurred in relation to the inputting of data from paper-based surveys completed by senior pupils (16-18 year olds):

> **Dean emailed to say that he had 100 responses to the survey but these were in paper format – should he put them into the online survey link or wait to include these in the next gathering. This is a tricky point for the power dynamics of the group. In one way, I should have said to contact the rest of the group and seek their replies through Moodle [an online discussion platform], but this is not a mechanism that has had much in the way of swift engagement in the group – and there is only two days until the next gathering! Therefore, I replied to Dean to say this was tricky as we would have lots to do in the gathering, but equally didn't want to say that all the paper versions had to go online before the gathering. I suggested a middle ground: trying to put some paper responses into the online survey in advance and then we would split the remainder and input them at the start of the next gathering. (Research diary, 15th Sept 2017)**

Moodle[25] – an online communication platform I suggested for group discussions (discussed further in section 4.3.1) – had limited participant engagement, so although I wanted to suggest that Dean sought views from the other participants to his dilemma through this medium, the minimal time before the next gathering encouraged me to be more direct. The middle ground option I suggested was a balance between my aspiration to avoid using time in the gatherings for tasks that could be progressed by individuals, and recognising the pressured time that Dean would have to transfer the data. A combination of younger people regarding adults as having more knowledge or authority (Taft 2015) as well as adults having a major influence on how young people spend their time, such as in school, clubs, and work (Ennew 1994) could have been factors in Dean explicitly seeking direction for his dilemma from me. However, my adult status was only part of my identity and is likely to be too simplistic a reason: being the instigator of the overall Young SAGE project and acting as group coordinator were alternative motivations for Dean's action and not just the straightforward dichotomy of adult and young person.

In addition to these elements of my identity, I was also a recognised member of University staff, which was made explicit to participants through recruitment materials and our gathering locations, and was a positive aspect for supporting the planning of the Young SAGE event:

> **Lisa: If we wanted to do experiments would the University just give us stuff or would that not be that…?**
>
> **Stuart: We can, we can see. I have contacts with others who do activities with schools […]**
>
> **Emma: Also I did a week of work experience at Dynamic Earth before, so I still have a contact there. So I could email them and give like your contact details sort of thing as well.**
>
> **Stuart: Absolutely. Yeah. Yeah yeah. And then there's the Science Festival people too […] And then there's the other universities as well**

[25] https://www.moodle.is.ed.ac.uk/

[…] So is it worth me already at this stage getting in contact with some of my colleagues to give them advanced notice or…?

James: How much advance notice would your colleagues like?

Stuart: I wouldn't really know. From my own experience, I know that over the summer period people start to plan when they can be doing things in the next academic year… (5th Young SAGE gathering, 18th June 2017)

My status as a university representative was used by participants in a productive sense: instead of my role being more privileged, there was a more equitable exchange, where the participants were seeking relevant insights into the working practices of the university. This discussion resonates with the actions of members of the Michigan Community Foundation Youth Grant Making Project who sought the experience of adult advisors to support their development of evaluation resources (Richards-Schuster 2012). However, even when explicitly asked, it is important for adults to be reflexive in the amount of advice they provide since talking too much could result in a disinterested audience and a possible re-privileging by the adult of their own inputs. In Taft (2015), this risk is illustrated by Joaquin, a 15-year old who is evidently frustrated with the dominant role adults take in providing too much introductory information in his intergenerational project experience. Within Young SAGE, by saying "I wouldn't really know", I could be reflecting my desire to avoid this self-privileging. Further exchanges seeking my contributions occurred throughout the project, especially in the thirteenth gathering where there was a renewed focus on developing an event for early secondary pupils and a need to explore how best to contact my university colleagues and request interactive hands-on activities, and to refine potential venue preferences.

Additionally, there were occasions where participants would specifically share their views or inputs with me outside of the gatherings, despite opportunities for individuals to seek views from other participants. For example, in the seventh Young SAGE gathering we discussed the merits of seeking an indication from 16-18 year olds about their socio-economic status by either using respondent postcodes

to look up their Scottish Index of Multiple Deprivation[26] (SIMD) quintile or by asking respondents if they were eligible for local Widening Participation programmes and/or the Education Maintenance Allowance. In the gathering, we settled on the latter option, but – as seen in the following research diary excerpt – Mark was not convinced that this was the right idea and contacted me afterwards:

> **Mark prefers the postcode and SIMD approach, and has regularly completed an annual survey for [another University] in school where postcode is asked with no issue. I asked Mark to post these thoughts on Moodle as it would be useful to see what others thought. I also said that it could be argued that none of the measures are 100% accurate. (Research diary, 17th Aug 2017)**

Mark did not follow my request to use the Moodle discussion board, which could in part be explained by the group's relative lack of engagement with this communication option. Even so, Mark could have discussed his views with Dean as they went to the same school, but this did not appear to take place either. Mark may have been reluctant to raise his concerns with the other participants in a written format, due to feeling more exposed in comparison to making a comment during a more informal verbal conversation. From a critique of focus groups, the contributions of other participants can either encourage an individual to express their view with more confidence or conversely inhibit someone from making contributions that deviate from the group consensus (Kitzinger 1994). The latter impact could have discouraged Mark from raising his concern through the more exposing Moodle option. However, Mark still felt comfortable enough to share his thoughts with me in writing, potentially so I would revisit this discussion in the next gathering, and his action could hint at a greater level of comfort in challenging the decision with me only rather than the whole group. Therefore, having an adult working with young people in research offers additional opportunities for reflection on decisions, which may be more problematic to solely review intragenerationally.

[26] https://simd.scot/2016/

4.1.4 Resisting the privileged status bestowed by other adults

Throughout the project, I was increasingly aware of Young SAGE participants' assumptions that adults would treat them differently purely due to their status as young people. Reasons for this distinct treatment by adults result either from a lack of appreciation of young people's capabilities (Qvortrup 2005), or by regarding young people as incompetent (Montgomery 2009), whilst considering themselves as experts by comparison (Davis 2011). Although there were relatively few interactions with other adults (beyond me) during this project, I experienced episodes that aligned with participants' assumptions that they would automatically be subordinated by adults. One example related to the potential involvement in the Young SAGE event of a colleague of mine, who cast me as the decision-maker for the event's content:

> **I met [my colleague] to discuss the project following the specific invitation [from the Young SAGE group] to participate [in the event]. She showed me a few potential activities and discussed the possibility of a new one which could be piloted if ready. […] …this was a different example of me being looked to [for decisions] when I don't think it is the appropriate route. Here, my role in the University is a contributory factor: I have a wider view of public engagement across my College and I am working with the Young SAGE participants directly. From [my colleague's] viewpoint discussing the activities with me was a short-cut to get verification that the potential activities would be suitable. I was careful to ensure that I said the activities would be selected by the Young SAGE group, as it is important for everyone to know that they are leading this. My role is providing the support for the decisions and ensuring the admin (risk assessments, etc.) is adhered to. (Research diary, 14th Feb 2018)**

When supplying hands-on activities to an event, it is usually beneficial for the event's priorities and restrictions to be discussed directly with the event coordinator. This preparation was what my colleague was attempting to do with me as the assumed coordinator. In addition, our shared identity of working at the university could have contributed to my colleague's preference to seek immediate decisions from me, something I was keen to resist. My goal from the meeting was to understand what activities were being offered and report back to the participants

for their consideration, and through this arguably small action (Kirby 2004, Gallagher 2008) I sought to avoid the responsibility for the decision (and therefore the power) to rest solely with me. There were further instances of adults looking to me for information – teachers regarding the purpose of the survey, and potential event stall providers regarding their involvement in the group's plans – and I replied with what I knew, but also advised them to contact the Young SAGE participants for further details to impress upon people that I was not in sole control of the event plans. Through my actions, I attempted to challenge the assumptions of other adults that I was in charge of the project, and thus avoid a conception of an "adult-driven program[me]" (Larson *et al.* 2005b).

A further, more explicit, example of my privileged treatment by other adults took place when one of the teachers spoke to myself and the participants at the start of the event:

> **During [event] intro: teacher looked at me when explaining the STEM interests of the pupils and not really at the four members of the Young SAGE Team that I was in the middle of. Despite being in the same T-shirt design as the rest of the Young SAGE Team, I am still treated differently to the rest of the team. No matter how we work amongst ourselves during the gatherings, to the outside world there are expectations over the differing roles of adults and young people. The teacher knows that Alissa has been the main liaison for her school, not me, but the conversation is still directed towards me: I am an adult, part of the University, and ultimately responsible for things going safely during the event. (Research diary, 20th Mar 2018)**

Although there has been an increase in recognition of the 'voice' of young people within schools, through mechanisms like school councils, the impact on existing power structures has arguably been restricted (Taylor and Robinson 2009) due to a limited view of the capacities of young people and the consequent preservation of the traditional teacher-pupil hierarchy (Davies *et al.* 2006). The above excerpt illustrates how this hierarchy continues on an almost unconscious level. I was given a privileged position during the conversation, since the teacher's attention was directed towards me, presumably due to the normative expectation of the adult

being ultimately responsible for an event, compounding my status as initiator of the overall group (even if the choice of developing the event and surveys had been led by participants). This attention towards me was despite the event being labelled as the Young SAGE event and the participants and I were all dressed in the same Young SAGE T-shirts that had been designed by Emma and approved by the other participants.

Prior to the interactive event for early secondary pupils, the participants had been the main points of contact with representatives of the schools; I had no direct negotiation with schools regarding which schools would be attending the event and when they would arrive and leave. Yet despite my relatively hidden position with respect to the teacher during event preparation, in the excerpt I was still given the majority of her focus whilst she was talking. This interaction, amongst others during the project, reinforced the Young SAGE participants' assumption that they were regarded as subordinate in the view of adults (Qvortrup 2005, Vanderbeck 2007). For co-production research, this normative societal view of young people is problematic since it poses particular challenges for the exchange of power as they will be assumed to have weaker influences and consequently have to 'prove' their influential status before being taken seriously by adults. Although progress can be made to address the power dynamics within the immediate intergenerational research group to avoid the belittled status of young people, this progress does not necessarily influence the actions of other adults, which impacts on how research can proceed. In combination, these markers of difference imply there is little chance of success in taking a 'least adult' role (Mandell 1988, Christensen 2004, Spyrou 2011) in collaborative contexts.

4.2 Contextual influences on my expectations

Resulting from the adult-instigated nature of my research, especially as a PhD project combining with my work context, I felt pressured to ensure the progression of Young SAGE – a pressure that consequently influenced my actions. There were

occasions where I had reservations about the ambitions we had set: the development of a survey to explore what science experiences 16-18 year-olds would have wanted at a younger age and using the results towards the planning of the Young SAGE event, as well as further pre- and post-event surveys around this activity. I was principally anxious about: the time and effort needed for these ambitions based on my previous event-management experience; challenges for managing the Young SAGE event and the potential damage to my work reputation; and times where the group's momentum seemed slow and the implications for my PhD timeline.

4.2.1 My event-management concerns around the ambition of Young SAGE

From the fourth Young SAGE gathering onwards, the goal of undertaking surveys linked to a participant-developed event was the group's main focus, which I considered could be overly ambitious based on my prior school-event experience:

> **Getting whole clusters of schools together could be challenging logistically and so we might have to discuss scales and expectations in the next gathering where we look at what will be achieved. Getting public engagement practitioners and researchers [to provide stalls] is another level of complication for an event as well, although it would be worth exploring what could be achieved and keeping an open mind at this stage rather than aiming too low from the outset. (Research diary, 23rd Apr 2017)**

At this time, following the fourth Young SAGE gathering, I reflected on my own concerns but chose not to be led by them. I wanted to avoid a presumption that executing the Young SAGE plan would be too ambitious, since I would have restricted what was possible on behalf of the group and made this decision for them. My attitude echoed that of Dahma (Le Borgne and Tisdall 2017), a member of a non-governmental organisation in India, who was sceptical of children's plans to get a temple built in their region, but Dahma supported their ultimately successful ambition by linking them with a local community leader. Although I had similar concerns about the scale of the Young SAGE project, I had never previously worked

with a group of enthusiastic young people, so I could not know that the project was too ambitious:

> **By nature I am more cautious, and so in August I had a feeling that the plan was ambitious, but I didn't know it was going to be too difficult. In fact, that's still the case today: I don't know that the plan is too difficult! The plan of multiple surveys and events is ambitious (in my view!), but a decision on whether it is too ambitious needs to be the conclusion of a group discussion, not by me introducing this as my judgement. I am not automatically better than the others in the group and they are not my team to control and order around. We are working on this together and we need to consider what is best for the objectives we have set. (Research diary, 24th Sept 2017)**

If I had shared my concerns about the Young SAGE project's scale, I would have privileged my position ahead of those of the participants, and by avoiding this temptation I differed from the approach of youth councils (community-based committees involving young people often established by adults). Matthews and Limb (2003) suggest that adults involved with youth councils should outline the constraints under which the young participants are operating; a view supported by literature into participation and social justice (for a brief summary, see Davis and Smith 2012). Although we discussed the funding available for the event venue, the idea that I was in a position to articulate the general parameters for the Young SAGE group was impossible, since I was viewing the participants as "…agents with a wealth of experience/views…" (Davis 2011: 23). Their views on what we would achieve would affect my own, and thus our collaborative parameters.

Through my work role I might have had more event-management experience than the participants, but I had not worked collaboratively with others to the same level as I experienced in the Young SAGE project. So despite any concerns I held, I also realised in the previous excerpt that 'I don't know that the plan is too difficult!' My research framework did not define my role as directing a team to support my pre-determined plan. If a decision was to be made to change the structure of the project – the surveys around an event – this would have been a collaborative discussion, just as the project itself had developed collaboratively.

4.2.2 Hesitations in managing the event and contending with reputational risk

The lack of a genuine group-wide communication option – one where all voices could speak and be heard by all others – contributed to the tensions I faced in the latter stages of Young SAGE event preparations. In my work role, I seek to address as many aspects of an event in advance to reduce the possibility of misunderstandings and ad-hoc adjustments during the event. This mentality caused me significant tension in the weeks leading up to the event, as I felt under-informed about event preparations:

> **Megan had indicated in yesterday's email that it should be possible for the responses to stall providers to be sent today. However, as at 8:10pm [today], this hasn't happened. This is a tension for this style of project: I have to trust that the things that need to happen for the event to come together will happen. I have no doubt that the participants are keen and enthusiastic about the idea, so potentially I have not given enough time/support to explore what organising an event demands, leading to a potential underestimation of what's involved. (Research diary, 2nd Feb 2018)**

Through this reflection, I recognised that I needed to trust the process, but I also questioned whether I should have prepared participants in managing the event, although this preparation would have been in tension with my co-production foundation. I aimed to guide the participants, and did not seek to impose, aligning with the goal of the Open University's Children's Research Centre which minimises "…adult filters by repositioning the balance to *supporting* rather than *managing* children's research" (Kellett 2011: 208, original emphasis). However, maintaining a supportive role can be difficult to maintain, for example, the child research reports in Kellett *et al.* (2004) have the hallmarks of a template being used (see chapter 2): it is not made clear whether this template was imposed in advance by adults – thus attempting to manage the process – or if it was offered in response to a child-researcher request, and therefore a supportive action. During the Young SAGE project I offered support in the form of an event planning sheet, but respected the participants' choice in not using it.

During the twentieth gathering (after the Young SAGE event), some of the event-management obstacles with which participants had to content were reflected on:

> **Dean: So you need to be aware of who you're working with, and be fully prepared [Jess agrees] for the challenges.**
>
> **Jess: You have to go to extra lengths [Dean agrees], as people may not take you seriously due to the fact that we are youngsters.**
>
> **Dean: Looking retrospectively we probably should have put on the pressure on the teachers and also spoken to them sooner.**
>
> **Jess: Yeah and even with our thoughts as well, we were expecting a really big event with loads of people offering their services, we maybe overestimated how much people were going to help us which is something that we learnt from. (20th Young SAGE gathering, 31st July 2018)**

Although there would be other factors behind the challenges in event organisation (e.g. other commitments of activity providers; whether the right people were communicated with; exam preparations limiting the capacity for teachers to organise educational visits; etc.), this discussion further illustrates intergenerational tensions which, here, directly led to participant hesitancy in pressing for progress. In the period before the event, I did not fully appreciate these concerns around the power dynamics beyond our group. Only through later reflection, supported by the discussions in the twentieth gathering, did I begin to unravel the contributory factors to the Young SAGE event postponement: my initial resistance to impose my event-management approach; the underestimation of participants and myself in the preparations teachers needed to make to bring pupils to the event; and participants' hesitancy in making explicit requests for event-management support.

Unfortunately, within 'child-led' and intergenerational research (e.g. Mayall 2000, Kellett 2011, Wyness 2013, Kumpulainen *et al.* 2014), little light has been shone on research protagonists' potential hesitancies in how they work together, with attention instead given to the adult and/or young person actions that directly resulted in project progression. Within Young SAGE, of course we progressed the project, but ahead of our decisions there were also occasional periods of hesitation

and uncertainty. For example, after making the decision to postpone and agreeing a new date, I experienced a concerning silence from participants; the lack of a group-wide communication option again caused this problem as I could not be sure whether the silence was genuine or whether participants could have been using the group chat option to share information without my knowledge (discussed further in section 4.3.1). Although the group chat provided a communication space for participants to freely share ideas without my involvement, it also provided an obstacle to my coordinating role.

After a couple of email attempts to foster discussion – which resulted in Megan's confirmation of low email activity with potential stall providers – coupled with my concern over the potential for a second event postponement, I overcame my reluctance to take a leading role in liaising with those providing event content and asked Megan if further support would be helpful:

> **I really didn't want to get involved with this part of the event-preparation process, but my professional role in the University hasn't allowed me to let this go! (Research diary, 14th Mar 2018)**

As well as wanting there to be a positive and tangible outcome from the project, I had existing professional relationships with many of the potential contributors to the Young SAGE event and I did not want my reputation to be affected by the potential for the event to not go ahead at all. I predicted that if the event did not take place on 20th March, then it may not have due to the exam period shortly afterwards. Therefore, after the 14th March 2018, I took (what I felt was) a leading role in confirming the arrangements with the stall providers, in addition to the venue, but I still attempted to seek inputs from participants through emails. Although I received some views from some participants in this way, my distinct impression was that I had taken over (see section 5.3.2). The absence of an inclusive, group-wide communication forum prevented participants and myself making positive progress during the pressured period just before the event. Consequently, I protected my reputation over preserving the collaborative ethos of Young SAGE; a decision that participants fortunately endorsed, albeit in retrospect.

Within intergenerational research, this tension between managing a professional reputation and a collaborative ethos could pose personal challenges for adult researchers, challenges that might not be possible to resolve with the input of project participants due to time and communication constraints.

4.2.3 Challenges for the continuation of the project and PhD timeline pressures

The key moment for the ambition of the Young SAGE project took place in the thirteenth gathering. In the period before this (i.e. the latter part of 2017), I felt that our progress had been very limited:

> **It feels like the momentum of the project has dropped slightly, which will partly be as a result of my absence from 18th November to 6th December […] there was an enforced minimum of five weeks between gatherings. This gap required the participants to make progress without being able to seek my support if required. […] the pre-event survey and early arrangements for the events have not been undertaken. Therefore, I haven't enabled the participants to progress the plans independently, despite thinking that I had successfully achieved this. For example, the Google Forms version of the pre-event survey was meant to be converted to a Word document format and then distributed, but this didn't happen. The participant who offered to do it, didn't, and no one else in the Young SAGE group seemed to encourage this participant to make this action happen either. (Research diary, 15th Dec 2017)**

I blamed myself for not enabling participants to distribute the survey and advancing event preparations. My absence was planned and participants knew about this in advance, but my lack of contact during my absence may have played a role in other priorities taking a more prominent place in participants' lives. Additionally, many of the participants had mock exams to prepare for, which might have impacted on the capacity of individuals to give time to the Young SAGE project. The fact that one participant did not convert the survey drafted online to a paper format may have caused the others to wait: they may not have wanted to pressurise this individual due to priorities in their own lives. Furthermore, not everyone in the group may have supported the plan, and I had not enabled these dissenting voices to be

adequately heard during the course of the Young SAGE gatherings (Kitzinger 1994); however, although I did pose questions to explore the group's thinking at times, I did not aim to explore all alternative avenues. Since I expected progression after my return in December, the revelation that nothing had happened was devastating.

Therefore, ahead of the thirteenth gathering I needed to be flexible in what the next steps would be:

> **Started to do a schedule for the next gathering. In this I've thought of about four different scenarios: 1. Continue with current plan; 2. Amend and continue with current plan; 3. Think of new ideas that suit; or 4. Stop the project and review. I'm trying not to assume that the participants will suggest we move away from the current plan, although – given the date – I think this would be a sensible step. I don't want to make this decision for them, hence the consideration of the four scenarios. To be honest, I think that a short-term idea within option 3 is most likely: it gives us the chance to have an output from the project which will provide something tangible for us all to point to. I have thought of several ideas, but if this is where our discussions go to, I don't want to present them first: I'd like the participants to provide their ideas first. It will be a challenging gathering for us all, but it will be good to see what we're going to do next! (Research diary, 11th Jan 2018)**

If I was the sole decision-maker of the Young SAGE project then the idea of surveys around a bespoke event would have ended in January 2018, since – in addition to my PhD clock ticking (I was nearly 4.5 years into my PhD schedule by this point) – I was concerned with a lack of momentum and the time available ahead of April (when revision for the participants' final exams would have started in earnest). Ahead of the thirteenth Young SAGE gathering, I was ready for the group to reach the same conclusion and consider alternative ideas. However, to my complete surprise, the opposite happened: there was a renewed focus amongst participants (led by Dean, see 5.2.2) and a drive to achieve the existing plan ahead of April.

This focus may have been caused by perceiving April as a more definite 'final' deadline. In contrast to the six-month research plan presented to young researchers by Åkerström and Brunnberg (2013), I did not provide a clear deadline for our

Young SAGE project, since this was to be decided within the group as part of our collaboration. In Åkerström and Brunnberg (2013), instead of extending the project's duration when additional work was required, they simply scheduled additional sessions within the original period of the project. Within Young SAGE, the more open-nature of our collaboration meant we also had periods of more frequent gatherings, but we also extended our timeline when necessary. Participants had originally aimed for an event in November 2017 – since that was a quiet month in terms of holidays and exams – but postponed this to February/March 2018 following little progress in the summer of 2017. In January 2018, as anticipated, participants did not want to postpone the event beyond March due to Easter school holidays swiftly followed by the national exam period. This externally determined and immovable period might have motivated participants by providing a fixed deadline in the near future.

Therefore, for the Young SAGE project, I was incredibly fortunate to be undertaking the research on a part-time basis. Instead of three-to-four years to complete, I was given six-to-seven years for completing my study. Although part-time research suffers from competing priorities, especially in carving out sufficient time for research during pressured periods in the work context (Gatrell 2006), the longer duration of the PhD timescale enabled greater flexibility to respond to the specific participant choices for the Young SAGE project. Fortunately for me, they had 'hard' deadlines in the shape of their final exams and leaving school, which were within the scope of what I could cope with for my PhD progress, but periods where participants had additional pressures from other priorities (e.g. shift and summer work, school expeditions, holidays, etc.) still contributed to particular pinch-points for our project.

4.3 Researcher tensions between supporting the project and responsibilities: perceived and actual

In this section I explore examples of specific tensions that were substantially intertwined with my unique project status. Firstly, I focus on my difficulties in enabling online communications given the ethical responsibility for confidentiality. I then examine how a commitment to child protection affected participants' agency. In contrast, away from ethical research dimensions, I close this section by exploring how I respected the group's decisions despite personal concerns around the proposed use of survey-based methods.

4.3.1 Online communication channels versus confidentiality

As touched upon earlier, I wanted a communication option for all group members that retained an ethical commitment to participant confidentiality. A key benefit of online communication is the sharing of ideas at convenient times for individuals, rather than waiting for in-person gatherings (Mawn *et al.* 2016). However, for digital platforms that are not completely within researcher control, Elsley *et al.* (2014) draw attention to issues of confidentiality and anonymity within research contexts that result in additional ethical complexities.

The problems for maintaining anonymity had to be confronted within the Young SAGE project. Towards the end of the second Young SAGE gathering, Emma turned the group's attention towards ongoing communication preferences:

> **Stuart: When would we want to meet again?**
>
> **Megan: Pretty soon. / Several: Yeah.**
>
> **Jess: Get back in touch to see.**
>
> **Emma: Another thing we'll need to do is like decide how we going to communicate between the meetings, cos we've run out of time for that at both meetings so far.**

Lisa: We could use Edmodo[27].

Megan: I think Edmodo would be like one of the best options…

Jess: …because everybody's got Edmodo, or most people have Edmodo.

Several: Yeah.

Stuart: Who's got Edmodo? Okay that's six [people].

Alissa: There's also a messaging group or something (LH: We've got like a WhatsApp) or like WhatsApp or iMessages.

Megan: WhatsApp is, can be a bit personal that's my view. I mean you can see people's phone numbers and things…

Alissa: Yeah

Stuart: Yeah, yeah, which people may not like but may do so.

Emma: If everyone was okay with it, it would be quite good.

Megan: And you also want like a place where you could like send things, like files and stuff.

[Megan / Jess then describe Edmodo as an "educational Facebook"] (2nd Young SAGE gathering, 5th Feb 2017)

The possibility for participants to communicate between gatherings was not only important to me: Emma raises the idea independently with other participants quickly contributing their supportive thoughts. In contrast to a WhatsApp group where personal contact details would be shared, Edmodo was an option swiftly endorsed and had the additional benefit of being known by the majority of the group. However, as stated in my research ethics application, I wanted to preserve the confidentiality of individuals, and I therefore had to explore whether participant details would be protected by Edmodo.

Unfortunately, despite some basic commitments to confidentiality (e.g. no tracking information requested from users), further investigation revealed that 'students'

[27] An online communication platform that connects pupils, teachers, and parents: https://www.edmodo.com/

(the status named by Edmodo) could post profile pictures, add personal email addresses and phone numbers, and their IP addresses would also be collected. Furthermore, Edmodo could be taken over by another company, which would mean another third-party would have access to personal details and potentially change the terms and conditions. Consequently, I decided not to pursue the Edmodo option, as I prioritised confidentiality over the choice of the Young SAGE participants, despite my fundamental intention to support participants' decisions and recognise their capacities. My action aligns with Lohmeyer's (2019: 14) critique of participative research with young people:

> Young people are simultaneously considered to be vulnerable and in need of protection, as well as capable and active contributors. Ethics processes weigh on the paternalistic side of this equation and reduce the possibilities for pure participant-led research to near zero.

Therefore, the capacity for participants to lead (perhaps even specific aspects of) projects within formal research structures is severely limited, as there is external pressure on the adult researcher to act protectively in spite of their own recognition of young people's agency. At this early research stage, I suffered the same conundrum and subsequently explored whether an equivalent to Edmodo could be set-up within the University infrastructure. Eventually, my explorations led to Moodle, which enabled group-wide communications through a message-board approach; the administration of which was within the University's information security policies. However, in contrast with the claimed success of the web-based platform in Åkerström and Brunnberg (2013) for their research alongside late-secondary school pupils in Sweden, the Moodle platform offered only minimal positives in enabling group communications for Young SAGE since the additional log-in process appeared to present an engagement obstacle:

> **Megan: I know how to use [Moodle] I just haven't used it much; it's not that I don't want to this just kind of like…**
>
> **Stuart: It's fine.**

Emma: You just have to like go to the Internet and log in. [Overlapping comments] If only there was an app for it.

[…]

Emma: Maybe people would be more likely to check it or like go onto it if there was an app rather than logging in every time. I don't know. (5th Young SAGE gathering, 18th June 2017)

Emma's perspective was perhaps not shared by everyone, but for those new to the platform, the process of using a web browser to access the site instead of a quick tap of a smartphone app icon was implied to be a significant barrier[28]. So although there was interest in having a group-communication platform, Moodle did not provide an option judged suitable by participants.

Therefore, after the eighth Young SAGE gathering, participants established their own idea-sharing channel to prepare the pre-event survey aimed at early secondary school pupils. This communication option (based in Facebook) became known as the 'group chat', and was an explicit rejection of Moodle, thus illustrating participants' agencies. Their choice supports previous claims that young people seem to prefer less formal (from an adult perspective) engagement methods (Wyness 2013). This preference can be reflected in the variation in understandings gained from respective formal and informal approaches; for example, Holland *et al.* (2010) in their participatory study with young people in local-authority care found that data through formal group interviews was far less insightful in comparison to that generated through informal conversations. Additionally, within the Young SAGE project, it is noteworthy that eight months after the first full-group gathering, there were no participant concerns that the group chat shared personal contact details, which contrasted with Megan's comment in the second Young SAGE gathering stated earlier: "WhatsApp is, can be a bit personal that's my view. I mean you can see people's phone numbers and things." This shift suggests greater trust amongst

[28] There is a Moodle app, but it was not possible to use this to access the university's version of Moodle.

the group members given their more developed relationships, in addition to frustration with the formal Moodle option.

Thus, the group chat presented a situational ethics dilemma (Tracy 2010), since my ethics application stated that participants' identities would be kept confidential – a commitment that the participants' group chat contravened – but I needed to reflect on how great an issue the group chat really posed. On a positive note, although I could not know precisely how the group chat enabled participant communication, there were times when the outcomes were clear. For example, Alissa informed me of the group's preference for postponing the early March target date for the Young SAGE event within a relatively short period of time; a situation we discussed after the event:

> **Emma: Cos even in the group chat we were not [Sarah laughs] really getting anywhere: "my school's pulling out" "my school can't do this" blah, blah, blah, and everyone was starting to panic, "oh no, it's going terrible."**
>
> **Stuart: I love the group chat: to me it's like a black box [group laughter] – I have no idea what happens in your group chat. In some respects…**
>
> **Emma: You can join, but I don't know; it's a bit all over the place.**
>
> **Stuart: …in some respects I really want to know what goes on in there, but in other respects, I'm like…**
>
> **Sarah: Best not!**
>
> **Stuart: No, it's just, it's your space. Cos if I was involved in that space…**
>
> **Dean: They're just saying mean things about you!**
>
> **Emma: Yeah we're all like, "Oh that Stewy! Honestly!"**
>
> **Stuart: But maybe there's things that it's easier just to chat about in that space without me being involved. (Post-event discussion, 20th Mar 2018)**

Without the group chat existing, given the lack of engagement with Moodle, then participants could not have shared their concerns as swiftly and the decision to

postpone would have been more problematic. Although I would have known this outcome earlier if I was involved within the chat, my (digital) presence may have affected the dynamics of the discussions due to my unique project status. In the excerpt, Emma tentatively suggested that I could join the group chat; however this suggestion was quickly questioned by Sarah: her reluctance could reflect a desire to retain a space independent of my attention or potentially she did not want the informal style of communications to be revealed to me. Either way, the fundamental issue was my more formal attitude to communications.

In the end, I was left on the outside of the group chat, which presented not only an ethical dilemma, but also reinforced my distinct status and was potentially problematic for my research as I could not use any of this data. However, I was collating substantial data through other aspects of the project anyway, and my observation of the relationships between the participants reassured me that the risk for ethical issues was small. In any case, participants could share contact details privately if they wanted, and the majority of participants had pre-existing relationships through their schools anyway. Consequently, I chose to respect the participants' agency and made no attempt to restrict their group chat choice. Towards the start of the project, my commitment to confidentiality encouraged me to avoid approving a platform that could compromise their personal data, but at this later stage – with participants agreeing between themselves what to use – I did not feel comfortable attempting to 'ban' an option that participants themselves appeared comfortable in using, especially given my knowledge of the positive participant relationships that had further developed in the intervening period.

4.3.2 Child protection versus participant agency

The tension caused by the development of the Young SAGE group chat, also demonstrated a positive example of participants' agency and moulding the project in their own way. However, my role within the group meant that, at times, I acted in a way that impinged on this agency due to a requirement to reduce risk (Daley

2015), to protect young people and avoid harm (Lundy and McEvoy 2012, Lohmeyer 2019), despite attempting to balance this with respecting the participation of all group members (Mayall 2012). Therefore at times, my child protection-motivated actions elevated my position within the group.

For example, as part of arranging our gatherings, I asked participants to confirm their attendances by email in advance. Where I had not received confirmation by the morning of a gathering, I phoned the participant to check they would be attending. On one occasion, I did not manage to connect with the participant and therefore phoned his responsible adult to verify that the participant was fine:

> **It is unlikely there is a safety issue, but seeing as though I didn't expect Rory to not appear, there is a protectionist side to this. Perhaps I shouldn't have contacted his father, but I have prioritised the need to ensure he's safe over treating Rory as an independent individual. (Research diary, Sun 19th Mar 2017)**

I was on the horns of a dilemma: I wanted to respect participants' agency, however I also had responsibility due to my university-researcher status and procedural ethics commitments (Powell and Smith 2009, Tracy 2010) to ensure participants' safety. I considered the worst-case scenario – something had happened to Rory on his way to the gathering – and responded accordingly. The participant was of course fine, but I could not take the risk. My act of phoning the father reinforced my distinct role in the project.

A further challenge to respecting the agency of the participants occurred during a discussion about the focus and duration of a following Young SAGE gathering and the potential options for lunch.

> **Participant[29] 1: Can we order pizza? If we're staying for longer?**
>
> **Participant 2: No, no pizza!**
>
> **Participant 1: Oh!**

[29] 'Participant' is used in this section rather than their agreed pseudonyms as not all participants wanted their pseudonyms to be used in relation to this discussion.

Participant 3: Not because of recent, she had a pretty bad time…

Stuart: Oh okay.

Participant 1: [Name X] threw up on the pizza.

Participant 2: [Name Y] talked about that earlier…

Participant 1: Yeah it was disgusting, it was the worst thing, it was like.

Participant 2: So disgusting!

Participant 1: It was so upsetting, it was like...

[Brief aside about Chinese food as an alternative]

Participant 3: How much do you have to drink in order to do that?

Participant 2: She didn't.

Participant 1: She didn't even drink that much.

Participant 2: No.

Participant 3: Oh God! I'm sorry but how do you get in that state is my question?

Stuart: Yep.

Participant 3: Some people just don't have any self-control.

Participant 4: Respect the food.

Participant 1: I know right? Like she could've like went to the bathroom where the food wasn't. [Slight group laughter]

[Overlapping comments]

Participant 2: Yeah, but she didn't have to throw up on my pizza! (3rd Young SAGE gathering, 19th Mar 2017)

This incident of a friend of some of the participants being ill – supposedly due to alcohol – was conducted in a light-hearted way. There were no obvious issues shared by any participants, and so I genuinely felt no concern for the third-party who was unknown to me. Participant 4 did not appear concerned either judging by her contribution of 'respect the food', despite not knowing the individual involved.

However, I was still slightly uncomfortable during the discussion, which was reflected by my brief utterance of 'yep': although I did not think there would be any problems, I still felt a responsibility of care due to my status as an adult researcher. I am used to engaging young people through my work and this experience helped my project particularly for considering different scenarios for the formal ethics applications. However, for this specific example, I felt immediately discomforted. The participants could focus on the humour of the situation, but I felt a responsibility – due to the asymmetric onus on me as the adult researcher to ensure no harm (see Lohmeyer 2019) – to check there were no longer-term issues for this third-party. Regardless of the situation, the protection of young people is a primary imperative on adults (Bradbury-Jones and Taylor 2015). Consequently, I wrestled with this tension of participation and protection for a number of days, but eventually contacted Participant 2 to ask about any longer-term problems. They quickly confirmed there were no issues and apologised – an exchange I reflected on in my research diary:

> **[Participant 2's] response was very understanding, which caused me to respond by saying that [I] was embarrassed to have to check and assuring [them] that [they] didn't need to apologise at all. Our different roles have been affirmed here […] [Participant 2] is in a 'lesser' position which is confirmed by [their] apology and understanding of my position of checking on concerns. […] My role is a more powerful one: there is a responsibility of care which has resulted in a request (demand?) for further information and reassurance that there are no prolonged issues. (Research diary, 29th Mar 2017)**

Although I was sought reassurance successfully, the very action of checking with Participant 2 about the third-party prioritised child-protection commitments and concurrently negatively impacted my commitment to work collaboratively with participants. For Participant 2 especially, and for others too, my action may have negatively impacted their growing confidence in playing leading roles in the direction of our collaborative project. Although I was aware of this potential, and wanted to avoid acting in a way that endangered the collaborative project ethos, the normative societal expectation to protect young people – reinforced by the

formal ethics procedures – meant I relented and prioritised protection over agency at critical points.

4.3.3 Respecting decisions versus use of research methods

In contrast to earlier tensions in this section, which relate to ethical issues, the final area of researcher tension on which I focus arose from my internal struggle around appropriately using research methods, survey design in particular[30]. In discussions about using surveys – a key element of the project plan – participants identified many limitations including: younger people struggling to clearly write their views; a potentially skewed sample caused by only science-interested people would respond; a paper-based survey may not provide sufficient response space; and respondent handwriting may be difficult to read.

Although I was aware of some survey best practice, I was unable to greatly support participants with their series of surveys: one for 16-18 year olds to inform the group's planning, and then pre- and post-event surveys for 11-14 year olds. From my limited perspective, there would be issues around sampling and the consequent impact on the use of statistics to draw conclusions (Andres 2012b), but I was not confident in explicitly advising. Some researchers claim that "Undoubtedly many adults have greater knowledge than many children in many areas of life…" (Kellett *et al.* 2004: 331), but for survey sampling, this was not the case for me. Furthermore, even if I did know more, for the power dynamics of the group I did not want to impose changes to the plans independently. Therefore, due to my uncertain position, I instead used questions to encourage participants to reflect and check they were content with their choices, as illustrated in this discussion about what was needed for the different surveys within the project:

> **Stuart: So we think we're going to get pretty decent responses from the 16, 17-year-olds. What about the, what would they be 12-year-olds, 11, 13-year-olds, something like that?**

[30] Reflection and analysis around training considerations is presented in 5.1.1.

Emma: They might be a bit more difficult. We would have to be careful like how we asked the questions and stuff and maybe not have, you know in a survey you can say like click the box or type things, maybe not too much ones where you have to write your own response, cos I feel like they wouldn't have as big an attention span, no offence [slight group laughter] to 12-year-olds but.

Stuart: Don't worry, none of them are here. [Slight group laughter] We're good. Okay. So we'd need to have an approach where it's very much kind of a lot of tick box…

Emma: Yeah.

Megan: Hm hmm

Stuart: Okay. And would there be any problems with that sort of approach?

Megan: It's limited…

Emma: It's limited to what kind of responses but.

Stuart: Yeah. And do we think that could be a problem?

Mark: I think that might be why it might be a good idea to also chat to them… (5th Young SAGE gathering, 18th June 2017)

Although I did not want to make decisions for the participants, my questioning encouraged further layers of the plan to be explicitly opened up: more closed questions for the younger group; potentially limited data; and the idea of group interviews to secure additional information. Participants might have interpreted my questions as leading, but I attempted to temper this possibility by asking similar follow-ups (such as the focus on potential problems in this excerpt) to check whether the initial participant comments were just offering what they thought I wanted to hear (cf. Larson *et al.* 2005b).

From my limited foundation, participants appeared to have good awareness of the positives and negatives about surveys, but being aware of the impact of sampling was mainly demonstrated by James, who unfortunately left the project after the sixth Young SAGE gathering. My concern for appropriate sampling reappeared later

in the project, when there was a strong possibility that not all pupils from relevant year groups would attend our event, as I suggested to participants by email:

> **In my email [to participants]: "Our question is 'Can interactive science experiences change young students' interest in science?' If only certain classes from your schools will be coming along to the event, and we can already identify which classes these will be, could you just have the survey completed by only these classes and not entire year groups? Alternatively, should all of our schools be invited? Something to think about - I don't have the answer!!" For the purpose of answering their research question, it might be confusing to get all pupils to provide a pre-event survey if they are not all attending. However, they can still compare with the pre-event sample if they have some demographics from each responding group. (Research diary, 20th Jan 2018)**

Here, I was experiencing an internal conflict: I was encouraging participants to consider the wider picture without imposing my choice. Rather than shut down the alternatives, I again posed questions, in order to explore participants' thinking behind their decisions, but did not seek to take responsibility for these decisions away from participants (see Larson *et al.* 2005b). Again, my questions risked being interpreted as advising on a different course of action – only getting pupils attending the event to complete the survey – however, I sought to address this possibility by finishing my email: 'Something to think about - I don't have the answer!!' It seems likely that my questions were perceived as I intended, since in subsequent Young SAGE gatherings the participants' aim remained the collation of data from as many 11-14 year-olds as possible from their schools.

Taking a step back, if I did this Young SAGE project independently, then I would have sought pre-event survey responses only from the 11-14 year olds who were likely to attend the event. Therefore – since participants sought data from as many 11-14 year olds as possible – I successfully avoided imposing my preference on the participants. The tension here was caused by my own perceived issues regarding the use of survey methods, rather than any external stipulations like ethical commitments. However, the aim for my collaboration was to respect participants' decisions whenever possible, and although I employed questions to check on the

decision-making process and suggested external advisors for further support, I prioritised recognising their decisions over any misgivings I had related to the utilisation of survey-based research methods.

4.4 Conclusion

This chapter has illustrated the numerous challenges, at different scales, that confront the adult researcher within an adult-instigated intergenerational project, thus highlighting the pervasive influence of the generational order (Qvortrup 2005, Alanen 2009, Wyness 2013, Punch 2016, Punch 2019).

My markers of difference contributed towards a unique status in the group in comparison with the Young SAGE participants. For example, being the project instigator and coordinator and simply being an adult – thus receiving privileged treatment by other adults engaged through the project (see Spyrou 2011) – combined to reinforce my distinct role. Building on this, my background of event-management, having (and preserving) a professional reputation, and pressures from my work and PhD researcher statuses caused internal tensions that I tried to resist. However, I occasionally felt I had to put these tensions to one side, such as through my offer to participants to liaise with the event's stall providers. Further tensions originated from ethical commitments and my understandings of research methods that caused me to pause and reflect. For example, specific project developments that participants instigated in moulding the Young SAGE project presented possible ethical difficulties (e.g. the establishment of the group chat as an active alternative to the Moodle-based option I had offered).

Taken together, these different facets affecting my role had a direct influence on the possibilities for our collaboration. Momentarily putting my adult status to one side, and therefore ignoring the wider societal position that children and young people are subordinate (Vanderbeck 2007, Montgomery 2009), the responsibilities on my role as the instigator and administrator of the Young SAGE group and as a nascent university researcher contributed to my status in the group being different

anyway. It would be too easy and too simplistic to solely attribute the unique role I had purely to being an adult; the other elements of my identity (e.g. project instigator, etc.) also contributed to my difference. However, it still should be recognised that being an adult remained a further marker of my difference, which was reinforced by participants' interactions with other adults.

Research in the Young SAGE context suggests that the responsibilities on the adult researcher in an adult-instigated intergenerational participative context restricts the types of project that are possible in a formal setting. The 'child-initiated and directed' category within Hart's ladder of participation (1992) was never a realistic option within my research due to the procedural ethics requirements: a foundation had to be approved before my participant recruitment could begin. Indeed, the Young SAGE research context supports the claim that participant-led projects within formal adult-instigated scenarios cannot be achieved due to continuing power inequalities (Lohmeyer 2019), including – yet also beyond – demands of procedural ethics review board processes (Guillemin and Gillam 2004, Tracy 2010).

However, opportunities for collaborative working exist, and rely on the potential for contributions from all those involved. Although my adult status made me fundamentally different from the young participants, I have shown how my work role at the university offered positive insights into how we – as a group – could or should involve my colleagues with the planned event. Away from the ethical need to minimise risk (Daley 2015, Lohmeyer 2019), such as the choice and application of research methods, I was better able to respect participants' agency even if I disagreed with their decisions. I still sought to seek justifications for their choices mainly through questions and offered alternative options (e.g. external survey consultant), but the final decisions were owned by the participants. These examples illustrate how participants and I exchanged power through our interactions at different scales (Foucault 1980, Gallagher 2008) as discussed in chapter 2. Negotiating power does not come without risks for collaborative working, especially when tight deadlines require swift action, such as my offer to have greater

involvement with liaising with stall providers. Although in retrospect participants approved of this change, there was no guarantee that my action would have been received positively.

Therefore, it is vital for adults undertaking intergenerational research with young people to be aware of their differences and embrace them. The researcher may feel that taking on a coordinating role releases participants to progress the project on their terms (Davis 2009), but being the coordinator can reinforce the notion that the adult is leading the project with participants working under the adult's direction. If this happens, then the foundation of the research becomes less of a collaboration and more of a managed approach (Kellett 2005). Thus, the onus is on the adult researcher to state a commitment to collaboration – if that is what they seek – and work reflexively (Greenbank 2003, Basit 2013) to be aware of their markers of difference, their contextual influences, and their researcher tensions which will undoubtedly be brought to bear on how the project develops and evolves. It is challenging to resist certain influences – such as ethical commitments and the privilege other adults grant automatically – to maintain a collaborative intergenerational dynamic. However, this chapter has explored the significance of being aware of these dimensions, and how this awareness enables the adult researcher to consider appropriate adjustments in how they act throughout the research process.

It is important to explicitly clarify that I do not claim that participation itself is impossible within a formal, adult-initiated project: this chapter simply seeks to highlight the obstacles that were present for my own role working with the Young SAGE group. Obstacles like these need to be addressed in order to overcome the significant societal power imbalances that exist between adults and young people. Therefore, the next chapter explores how the negotiation of power between all members of the Young SAGE context enabled us to progress beyond the possibility of an adult managing a group of young research assistants and led to the participants owning different elements within the Young SAGE project.

5 Ownership of an intergenerational research project

In the previous chapter, I explored the challenges for an adult researcher in an intergenerational research project within a formal research context. I now turn to overcoming these challenges through a focus on project ownership. Although some researchers have explored the power dynamics between adults and young participants (Larson *et al.* 2005b, Mawn *et al.* 2016), as well as between young researchers and young research respondents (Schäfer and Yarwood 2008, Kellett 2011), there has been insufficient attention on how participants develop and sustain their sense of ownership over the collaborative projects in which they are involved. While Franks (2011) has explicitly argued for breaking down larger projects for participants to own sub-elements of the process, this approach has not attended to the emotional investment (Wiley 2009) that ownership requires.

Within the Young SAGE project, the impact of intergenerational power dynamics presented challenges for collaboration, but these challenges were not passively accepted and addressing these power imbalances led to a sense of ownership developing amongst participants. Based on the conceptions of the ownership of student learning brought together by Wiley (2009) and applied to the notion of project ownership by Hanauer *et al.* (2012) – discussed in section 2.4.4 – project ownership is suggested to involve:

Responsibility for the project	Commitment to the project	Emotional connection to the project

Figure 7: Framework of project ownership by Hanauer et al. (2012) based on Wiley (2009)

However, I found the above conceptualisation was incomplete for intergenerational collaborations, where attention is also needed to foster participants' sense of ownership. Thus, I propose the following framework for intergenerational collaborative project ownership:

Fostering project ownership through attending to power dynamics		
Responsibility for the project	Commitment to the project	Emotional connection to the project

Figure 8: Framework for intergenerational collaborative project ownership

In the first part of this chapter, I initially focus on how project ownership was fostered by developing participants' emotional connections to the project, and later reflected by their use of pronouns in referring to the project (Hanauer *et al.* 2012). Then the chapter shifts to participants' project responsibilities and commitments, and developing the core collaborative project (i.e. surveys around the bespoke event) from participants' original ideas. Within this project, participants developed different roles with some being supportive, whilst others led (Larson *et al.* 2005a). However, there were still challenges for how I supported participants.

The final section turns to consider how participants engaged people beyond the immediate confines of the Young SAGE group. Although we had some success in addressing the power imbalances between adults and young people within the Young SAGE group, tensions remained in engaging teachers and stall holders. However, reflecting on challenges I experienced around communications with stall providers highlights the subjective nature of the ownership concept.

5.1 Fostering participants' sense of project ownership: attending to power dynamics

Within this section, I reflect on the foundation of the Young SAGE project, particularly in terms of addressing the intergenerational power dynamics and addressing the normative adult-child interactions where adults set the direction, thus enabling a context encouraging collaboration between participants and myself (Wyness 2013). The active consideration of all aspects of the project's foundation, such as sharing decisions around arrangements for Young SAGE gatherings and research-methods training (Davis 2009, Kim 2016), contributed to working collaboratively and supported the group's decision-making processes. Following

this, attention is given to notions of ownership around the Young SAGE name, which I developed independently prior to the participants' involvement, but was positively adopted by participants as an important part of the group's identity. The final part of this section illustrates how a shift in participants' language when discussing the project reflected their developing sense of ownership (Hanauer *et al.* 2012) which offers useful insights for adult researchers when aiming to collaborate with young participants.

5.1.1 Organisational power dynamics: the subtleties of intergenerational interactions

As I explored in the previous chapter (particularly section 4.1.1), I felt an onus to set the tone for the Young SAGE group: I sought participants and needed to provide an outline for the research project. Thus, there was the risk that this onus could have developed into being the sole leader for the main project with participants being directed by me. Therefore, in the first Young SAGE gathering, I focused on creating a structure for our working relationship. My initial priority was to encourage participants to speak directly with each other and avoid a group-interview style, where I would ask questions and participants would respond directly to me. Consequently, rather than using group rules developed by others (such as Gibson (2012) in her focus-group approach with young people), participants were asked to develop the group rules together. After role-playing a disrupted group conversation, participants worked in small groups to share ideas whilst I listened in. Despite the risk of replicating a teacher-pupil dynamic (Fargas-Malet *et al.* 2010, Ozer *et al.* 2013), with the adult checking on what the young people were doing, my goal was to share responsibility for the group's direction as I discussed with participants at the activity's conclusion:

> **I've seen the use of [participants setting group rules] in other groups in that it shares the responsibility for how the group operates and that's what I want to try and get done with you guys as well. […] in future meetings I don't want to be the one saying "This is what we're going to be doing, this is what I can do." For the purposes of this project in**

terms of finding out what young people's preferences are for science experiences, it's your guys' ideas which are really going to be most important in figuring out the response to that sort of question. (1st Young SAGE gathering, 22nd Jan 2017)

By emphasising my purpose for the exercise, I reinforced the collaborative intent for the group. The broad outline was to explore young people's preferences for science experiences, but I wanted to avoid prescribing how this exploration would happen. Through my explanation of working together, I sought to avoid participants positioning me as the group's sole director. The resulting rules were called "Discussion Etiquette" by participants; the unusual nature of this name implied a sense of participant ownership that supported my collaborative aim. Further endorsement of developing group rules collaboratively was provided through Mark's positive reflection on this early task eighteen months later:

Mark: I liked the first [gathering], like when we set out the rules and stuff.

Stuart: […] So you liked doing the rules? Any particular reason?

Mark: Just so everyone is on the same page. […] I don't think it would have been any different, but I don't think anyone would have been nasty, but I just thought it was a good thing to start with.

Stuart: One way I could have done that was just to provide a set of rules. With that have been any better or worse?

Mark: That would have been worse.

Stuart: […] How so?

Mark: It was like a thing where we could all, it was the first time that we all work together, so […] it got the creative juices flowing.

Stuart: Nice!

Dean: You're not getting told what to do. [Mark agrees.]

[…]

Mark: It was good icebreaker as well. [Jess agrees] I was really nervous in the first meeting. So the icebreakers and like the rules, it was a nice introduction. (20th Young SAGE gathering, 31st July 2018)

During the first gathering, I (negatively) felt there had been little direct whole-group discussion between participants. However, given the period of time since the first gathering, it is significant that Mark commented so positively on this collaborative exercise. Creating rules enabled participants to work together, and as Dean suggested (although he was not part of the project at that point), avoided imposing my preference on participants, which contributed to the project becoming more participant-driven (Larson *et al.* 2005b). Furthermore, collaborating on the group rules meant that participants had contributed towards the basis of our interactions (rather than the adult deciding for them) and recognised their expertise (Davis and Smith 2012). Additionally, the above excerpt highlights how participants' discussions on a specific task helped to overcome initial nervousness, which I had not previously considered as an influence on participants' interactions. Every participant had met me through our individual introductory interviews, which helped my own confidence, but participants also needed time to build their relationships, as Jess suggested within a brief reflection that concluded the first gathering:

> **Jess: Breaking the ice first was quite good in fact, where we're now more comfortable with each other and we know more about each other. (1st Young SAGE gathering, 22nd Jan 2017)**

A further organisational tension surrounded the potential for providing research training, a topic of some debate within childhood studies (as seen in chapter 2). The UK's Children's Research Centre, based on the argument of empowering children, have developed a training programme covering all stages of the research process, from setting research questions through to the dissemination of outcomes (Kellett 2011). Åkerström and Brunnberg (2013) included training for participants in their six-month participative research project, while others (e.g. Matthews and Limb 2003, Roholt and Mueller 2013) advocate that training should be delivered for new members of youth councils. Based on her own participatory action research experience, Cahill (2007) argues that training participants is necessary to address power imbalances between everyone involved, including adult practitioners, by

ensuring everyone has a foundation in undertaking research. However, this view ignores who decides on the training required, which could unintentionally influence those being trained (Kim 2016), as well as obscuring the possibility that some individuals may have greater research experience than others. For the Young SAGE project, I did not provide training – aligning with Holland *et al.* (2010) and Cairns *et al.* (2018) – a straightforward decision since I wanted participants to lead project decisions. I did not want to risk accidentally directing participants through a pre-defined training programme. However, I was not a passive observer.

Over the course of a couple of gatherings, the group coalesced around the idea of surveys linked to a bespoke event for early secondary school pupils, although there were differing opinions around how to proceed. Rather than giving a direct input, and therefore implying I had greater expertise (Cahill 2007), during the fifth Young SAGE gathering I instead encouraged reflection on the methods to use by displaying quotes from various childhood and data-collection articles. Through this action I was not passive, but I avoided a directive status by offering a structure that enabled participants to clarify their thinking around the tools to use to answer their main research question (Larson *et al.* 2005b). Prior to the fifth gathering, participants had quickly decided on surveys being a key data-collection tool for assessing the impact of the interactive event and I wanted to explore that this choice was a genuine preference, which the exercise certainly supported.

Another area of tension was around the potential engagement of external survey expertise for appropriate survey practice. As the group had already made decisions about the event and surveys and we had had the opportunity to develop our working relationships, the input of a third-party would be less problematic for our power dynamics than if they were involved from the outset:

> **Care will need to be taken over the level of influence on the participants. […] A further benefit of bringing in a third party is that this reduces a 'special' status I have in the group. I don't know all the answers and seeking expertise from elsewhere reinforces the message that I am learning through this process too. The third party doesn't**

have to be an adult either, it merely has to be someone who is knowledgeable about surveys. (Research diary, 24th Apr 2017)

Here, mentioning my status reflects my awareness of the power relationships: there was a risk that advice could be perceived as direction, leading participants away from their developing plan. However, a potential positive of external input would have been an implicit signal that "I don't know all the answers…". I wanted to encourage the idea that we could seek support from others to complement expertise within the group. Later, I raised the idea of bringing in an external person to advise on surveys, which resonates in part with Franks (2011) in that discussions around the best way to undertake different parts of the research (e.g. who should interview specific research participants) is helpful in collaborative research with young people due to the power dynamics involved. Within the Young SAGE project, instead of focusing on power dynamics, I wanted to explore the level of assistance the participants thought would be beneficial and would help them achieve their research goals.

Furthermore, I did not want to insist on a third-party independently, as this action may have undermined participants' ownership of the project; they may have questioned the confidence I had in them (see reflections on hesitancy in section 4.2.2). In addition, I would have privileged my opinion that assistance was required, an assessment with which participants could have disagreed. The choice to secure external support needed group consensus to align with the collaborative Young SAGE ethos. Eventually, we never engaged a 'consultant': participants initially decided they wanted to make further progress to make best use of the third-party's time, and later decided they had progressed too far for another view to be worthwhile. Alternatively, it might have been that participants were not sufficiently confident to involve a new adult, but whatever the reason, the group took responsibility for the choice and decided what would be most beneficial.

Although I did not provide research-method training and we did not engage third-party support, I remained active in the development of surveys. However, my aim

was not to guide participants, as adult advisors did for the development of an event in Larson *et al.* (2005a), but to explore the reasoning behind participants' decisions. As one example, within the seventh Young SAGE gathering, participants revised a draft survey aimed at upper secondary school pupils, which would help inform event priorities. When the draft was nearly finalised, I asked about specific elements as I reflected afterwards:

> **I introduced the idea of having options to select between for question 1 (on past STEM experiences), but this was rejected as we may not include all possible options and so we may potentially miss something from the respondents. Dean seemed quite convinced by this view in particular.**
>
> **At one point, I questioned whether questions 2 and 3 in part 2 (the subjects studied, and the subjects enjoyed) were clear – especially the [question] about the subjects that respondents 'enjoy best': it wasn't clear whether a single response or multiple responses were intended. The solution the group came up with was to remove 'best' from the question. I also asked about whether the questions should be joined together – asked for an order of preference in one question… […] The group decided against this idea and kept the two questions. (Research diary, 13th Aug 2017)**

Thankfully my questioning was not perceived as directive, and this reflection signifies how our relationships had developed by this stage. Within the initial phase of Young SAGE, I was concerned with the low level of direct participant discussion, but this excerpt suggests a much stronger dynamic between participants through the phrasing "The solution the group came up with…", which reflects the participants' consensus. My approach of questioning participants' decisions reflected how I embraced my distinct role by this stage of the project, and also my growing confidence that participants would not treat my input as direction.

5.1.2 Young SAGE name and identity: the participants' emotional connection

For recruiting participants I wanted a project name to provide easy reference (see section 3.3.2.2). My intention was for this moniker to be temporary and that the

eventual participants would choose a name to foster a greater sense of ownership. However, when we discussed a name change, I was surprised by the strength of resistance:

> **Helen: What does SAGE stand for? I can't remember.**
>
> **James / Lisa: Science Advisory Group for Engagement. [Some laughter]**
>
> **[…]**
>
> **Stuart: Well about the Young SAGE name: my supervisor hates it!**
>
> **Emma: Hates it?**
>
> **Helen: What?**
>
> **Stuart: Absolutely hates it.**
>
> **Emma: I think it's cool.**
>
> **Megan: I hope your supervisor hears this, it's not a bad name! [Some laughter]**
>
> **[…]**
>
> **Stuart: Okay! But the name could change, if you want to change the name, we can change the name.**
>
> **Lisa: Into like what though?**
>
> **Helen: Exactly!**
>
> **[…]**
>
> **Jess: Young SAGE I think, just gets the point.**
>
> **Megan: Yeah. But nobody actually knows what it stands for! (4th Young SAGE gathering, 23rd Apr 2017)**

Despite people not knowing what 'Young SAGE' stood for, the group concluded that the name should remain. The incredulous response of some participants – including Helen who admitted she could not remember what the name stood for – emphasised an attachment to this name. Perhaps the reaction would have been different if I said that I was unhappy with the name, rather than attributing this

position my PhD supervisor, but I did not want to force the participants into creating a new name, so I tried to be neutral. I had assumed participants would need direct involvement with creating the group's name to contribute towards their sense of project ownership, as the group in Cahill (2007) had achieved. However, others have shown that participants do not need to be involved in all research stages in order to gain a sense of ownership: in Ozer *et al.* (2013), participants had greater autonomy in their participatory action research classes in comparison with their other lessons in school, a fact which encouraged their feelings of ownership. This excerpt from the fourth gathering illustrates how participants felt a connection to the name despite it being proposed before their involvement; a position which confounded my expectations.

In addition to the name, I also designed a Venn diagram image used in posters sent to schools, as well as social media promotion and the project website. The following discussion resulted from Lisa's request for further background information about Young SAGE to include in her draft university application:

Stuart: …but then also on [the website] is kind of the original application form…

Helen: With the Venn diagram!

Stuart: …which has the questions…

Lisa: The Venn diagram!

Stuart: …with the Venn diagram!

Megan: Wait, a Venn diagram?

Lisa: Yeah that one…

Helen: Do you like science…

Emma: Yeah, it's like "science, young people, the University"…

Lisa: …in the middle!

Emma: …question mark! I love it!

[…]

Emma: Yeah, it's science, young people, science, the University, and then in the middle of it a big question mark.

Helen: I thought it was a great Venn diagram!

Lisa: Yeah…

Stuart: Thank you very much Helen!

Lisa: …any Venn diagram is great!

Emma: I like it, it's cool! (4th Young SAGE gathering, 23rd Apr 2017)

Similar to the Young SAGE name, not every participant was aware of the Venn diagram, which I had designed to visually represent the important foundations of the research (Appendix 16). However, Helen's independent comment, followed by Lisa and Emma's enthusiastic recreation of the diagram, suggested a degree of resonance. Eventually, the image became a group logo within external communications. However, not every participant commented within the above exchanges, which suggests the name and logo was not equally important for all participants. For James, the lack of contribution to these discussions might have been due to his planned departure a short time later.

A deeper connection to the project's essence was emphasised by participants wanting team clothing for the event. This provided a strong visual and made the group's presence and status more obvious during the event itself. Emma, one of the more artistic participants, took responsibility to produce T-shirt designs that participants voted on. This process appeared to strengthen the affiliation of the participants with the project and emphasised their commitment. Some participants later surprised me by wearing their T-shirts in gatherings held after the Young SAGE event, an action which indicated a sense of pride in their involvement, with some participants wearing their T-shirts on other occasions too:

Dean: I love my T-shirt so much! I wear it loads, that's the reason I'm not wearing it now because it's in the wash! (20th Young SAGE gathering, 31st July 2018)

It seemed that through connections to the project's name, logo, and team clothing, participants developed an emotional connection to the project (Wiley 2009, Hanauer *et al.* 2012). Participants' sense of pride was reflected in their decisions to retain the project name and logo, as well as furthering their ownership by using the logo in communications and on the T-shirt. These decisions echo the adoption of ownership of a prototype learning toy within van Rijn and Stappers' (2008) participatory-design process, in which participants defended the prototype from outsider critique. The Young SAGE gatherings themselves further contributed to participants' emotional connections: Dean was at the forefront of articulating the positive effect of having Sunday gatherings, which were not the imposition on participants I anticipated:

> **Emma: We could do another Friday.**
>
> **Dean: I like Fridays and Sundays. For some reason.**
>
> **Emma: Yeah, Sunday's are good cos…**
>
> **Dean: Cos Sundays are usually, you get the Sunday blues [Emma: A chill day], but not if you've got SAGE! (Stuart laughs) (14th Young SAGE gathering, 19th Jan 2018)**

Although he commented in a humorous way, Dean's intention seemed honest rather than sarcastic, illustrating his personal investment in the project (Larson *et al.* 2005b). The discussion between these participants was very upbeat with rapid contributions from individuals. I had assumed Friday afternoons would have been the main preference for gatherings, but Dean's final comment suggested that his involvement in Young SAGE enabled him to overcome the usual negative feeling he would get on Sundays ahead of the new school week. In the following gathering, Emma supported this view by suggesting she would miss the project when it was complete. Although Brownlie *et al.* (2006) question whether it is ethical to ask children and young people to give up their free time, the response from the Young SAGE participants undoubtedly rejects this query.

So although the name and Venn diagram were developed without the inputs of the participants, this did not compromise participants' ownership of the project (Ozer *et al.* 2013), and in fact they positively adopted them. Participants rejected the possibility to develop new alternatives and questioned why a name change was needed: actions which somewhat surprised me since I assumed they would need to develop their own to avoid the idea that this was *my* project with which they were assisting. Through bespoke clothing that participants themselves designed and approved, they reinforced their emotional connections to the project (Killeen *et al.* 2003, Wiley 2009). This connection was also illustrated by the participants' commitment to have most gatherings at the weekend, which would be a significant proportion of their free time. However, although feeling ownership of the name and Young SAGE identity is one aspect, a complementary aspect is feeling responsibility for the project's purpose and reflecting this through verbal description as I explore next.

5.1.3 The value of language in reflecting development of project ownership

Through the subtle interactions between myself and participants in developing our working relationships (see section 5.1.1), we started to overcome the initial conception that participants would work under my direction. The use of first-person pronouns (I, we, our, etc.) in describing a project can be taken as an indicator of an individual's sense of project ownership (Hanauer *et al.* 2012). Therefore, attention on participants' language in describing the project provided an insight into how they perceived their project-ownership status.

As illustrated in chapter 4, in the first gathering participants suggested that I should be directing the project and consequently, there was a high concentration of second-person pronouns to refer to my role. Although I conceived that the power dynamic would be negotiable between us (Holland *et al.* 2010), this conception was not initially shared by participants who wanted a more obvious structure with my

role defining the key priorities (Cahill 2007). This was the conception that I wished to avoid, and I recognised that I needed to challenge the normative adult-young person dynamic where the latter does not expect to be treated as equals by the former (Punch 2002b). Despite statements I made in the application form and the earlier introductory interviews, I agreed with Luis' impression (see section 4.1.1) at this stage: I had set up the structure for the first gathering – since I prioritised developing our working relationships – and I would therefore need to improve efforts in sharing ownership as the project progressed.

An important stage in enabling participants to feel genuine ownership of the project was the group's discussion of their own ideas offered during the individual interviews that took place prior to the group gatherings. After discussing the different options, the participants reached a consensus within the third gathering:

> **Stuart: …and so thinking about this idea about finding out about young people's preferences for science engagement, how do these two things work with that aim?**
>
> **Megan: Well I thought, if we do two things, it depends if you would have the survey before or after [an event].**
>
> **Lisa: How about both?**
>
> **Megan: Or both, that would be green [a positive]. If you have it at the same time as you're doing another activity then, sure I guess, but if you had it before you could ask people what would you like to see from this experience…?**
>
> **Alissa: Like what have you already done or what can we do that's different?**
>
> **Megan: Yes. And then afterwards, we could ask their opinions of how the experience went or something like, or how did you find this? What could we have done better? (3rd Young SAGE gathering, 19th March 2017)**

Section 5.2 further explores how the development of the project enhanced the sense of participant ownership, but this discussion was a pivotal point for the project's purpose. Firstly, the use of "we" by Alissa and Megan indicated – in

contrast to Megan's use of "you" – how the participants were taking a greater responsibility of the project's goals. Secondly, the broad outline about exploring young people's science-experience preferences was my original suggestion, but the participants developed their own focus within this initial outline. This crucial moment marked the start of participants' project-ownership shift.

This change in participant language reflected their increased sense of project ownership (Hanauer *et al.* 2012), which grew significantly during our collaboration:

> **Mark mentioned 'our activities' when discussing the SCI-FUN exhibits, which was an interesting phrase: Young SAGE had nothing to do with the development of these activities, and it was me who suggested I could bring some of them along, but the group has worked with me for a VERY long time and we've developed good relationships, which has potentially resulted in a shared ownership for this event of these exhibits from my work role. (Research diary, 20th Mar 2018)**

This small phrase – "…our activities…" – fourteen months into the group interactions, emphasised the change that had taken place since the first Young SAGE gathering where participants were seemingly looking for direction. The interactive activities to which Mark referred were borrowed from a wider collection of activities from my workplace that comprise the SCI-FUN Roadshow. Although participants wanted these activities for the Young SAGE event, they did not develop them or select which specific activities to use. Despite this, Mark assumed that participants would be responsible for these activities during the event. His phrasing could have also implied I was granted a greater insider status by this stage: I was part of the Young SAGE project and therefore if I was responsible for the activities, then the participants were responsible for them as well.

5.2 Ownership of the project's development

Fostering ownership through attending to power imbalances was taken further by participants collaborating and developing a specific research project. A critical part of this process was the reintroduction of participants' ideas shared in the

introductory interviews, which enabled participants' original thoughts to form the heart of the project. With some acting as leaders and others in more supportive roles (Larson *et al.* 2005a), participants worked together on each aspect of the plan: the event and surveys to assist the event's design and to explore the impact of the event's activities on the early secondary school pupil attendees. Occasionally, they discarded ideas (such as group interviews immediately following the event), which enhanced their project ownership by taking responsibility for the project's direction.

Although participants made key decisions, it took time for me to achieve the right balance for my role. I wanted to be supportive but not directive, which can be difficult for adult researchers since they sometimes need to restrain themselves from getting too involved in decision-making processes (Larson *et al.* 2005a). Despite my increasing comfort with my role, I still met occasional challenges.

5.2.1 Producing project priorities through collaboration

In the latter part of the second Young SAGE gathering I began to encourage participants to develop the project based on ideas some of them shared during our introductory interviews before the first group gathering. By bringing their ideas back to them, I implicitly endorsed the importance of participants' perspectives for the project's progression; however, I struggled to maintain this ethos:

> **Task 3 [of the second gathering plan] is to consider the positives and negatives of potential group tasks that have been shared in the individual interviews as well as a couple I have thought of. This will be done individually at first using coloured post-its (to give an immediate visual sense of positive and negative comments). […] By doing this task individually at first gives the opportunity for all members to consider their own opinions initially and give them in a way which is not as immediately exposing as it would be if spoken in the large group. This method may allow a greater chance for me to get inputs from everyone, since it was clear that a couple of participants didn't really contribute in the full group setting [in the first gathering]. (Research diary, 1st Feb 2017)**

My early perception was that I was not ensuring all participants had the opportunity to contribute in the initial Young SAGE gatherings. Instead of verbally challenging participants who were quieter during gatherings (as some adult collaborators chose to do in Taft 2015), which would have conflicted with the project's collaborative ethos and compromised the agency of participants in how they chose to contribute (Punch 2016), I used a stage of individual reflection to ensure that everyone had the time and space to consider their views independently. However, the phrase "…may allow a greater chance for me to get inputs…" is problematic since it suggests that I was central to the group and signifies my difficulty in negotiating power dynamics with participants at this early stage. It was not for me to get inputs at all: the purpose was for all views to be shared as a basis for developing a collaborative project. Similar to the participants' conception that I should be leading the project (Punch 2002b, Cahill 2007) discussed earlier, and despite my expressed claims to the contrary, I occasionally lost sight of the intended collaborative ethos.

How participants flexibly treated the re-presented ideas from their introductory interviews offers important insights into their developing sense of ownership. Firstly, participants agreed that two of the ideas were sufficiently similar that they could be combined into a single category. Secondly, after individual comments had been made, Alissa – quickly supported by the other participants present – combined two ideas: surveys related to a bespoke event. These actions reflect an increasing sense of participant ownership: they made the choices without inviting my direction or approval. During our twentieth-gathering review, participants supported building the foundation of the main project in this way:

> **Stuart: …was it useful to [look at ideas from the introductory interviews] individually first and then talk…?**
>
> **Jess: Yeah.**
>
> **Mark: And it was good that you just got to write down everything, cos sometimes when you're in a group and you're just discussing, you can be a bit nervous about saying something when other people disagree, so if you just get to write it then you don't get that pressure.**

Stuart: Absolutely.

Megan: Also, it was kind of bonding activity […] because some of us had the same idea of how each activity would turn out and we could decide that maybe this is mainly a con [a negative] and, I don't know, this is something that we could all agree on. (20th Young SAGE gathering, 31st July 2018)

Within our brief review, two main benefits were identified. For Mark, the intragenerational interactions seemed to be concerning in the early stages, and therefore sharing his opinions through written comments was less exposing in comparison with a verbal discussion. Megan's reaction also illustrates the intragenerational aspect of the group, but in a more positive sense: she gained confidence (see also Larson *et al.* 2005b, Taft 2015) that her views aligned with others through seeing other comments of a similar nature. For different participants, the approach was useful in different ways: there was not a single benefit, reinforcing the notion that each person is affected by the people and environment around them in different ways (Thomas 2016).

Our collaborative ethos continued to develop and was particularly important within the thirteenth Young SAGE gathering, which – due to a lack of progress in late 2017 – was significant for the group's overall goals. Although I could not precisely plan the long-term structure of the project due to its collaborative nature (Cahill 2007), it was still important to look ahead and anticipate what participants wanted to do next (Kirby *et al.* 2003, Larson *et al.* 2005b), which I attempted through predicting four different scenarios (see section 4.2.3). During this thirteenth Young SAGE gathering, Megan suggested a smaller event for only twenty attendees as a test before undertaking the plan of a larger-scale event:

Dean: [the email to school teachers] says that we're organising [an event] and aiming for 26 February, so do we have time to do that [small-scale event] before, or would you make that into the test one? Because we…

Megan: I'd make that into the test one.

Dean: …we've already suggested a week [that the events would take place].

Megan: Do we honestly have a month and a half to make a full-scale event? Why are you looking at him [Stuart]? He doesn't have the answer! [Megan laughs] (13th Young SAGE gathering, 14th Jan 2018)

Megan's final comment is crucial for the project's ownership. Some participants looked towards me at this point – presumably to invite my input – reflecting their uncertainty. Perhaps participants were looking to avoid a direct confrontation by looking to me, or alternatively they were just looking for another perspective. Irrespective, Megan ruled out seeking my view, indicating greater responsibility for the project, and going beyond the feeling of equality with adult researchers that young participants are argued to seek (Hopkins *et al.* 2017). She did not want to decide completely independently, but she did want the other participants to contribute and not me. Led by Megan, the group later returned to the topic of a 'control group' and concluded this would not be a productive use of time:

Megan: Do we choose people to come along or not?

Sarah: Wait, are you talking about the control group?

Megan: Yeah.

Sarah: Do we want a control group?

Dean: I'm not sure.

Sarah: I don't know…

Alissa: I just feel like we're running out of time in the year, and so the control group might waste a bit of time where we are better focusing our energy on the main event. Yeah it would be a good experience to see how they like it, but we are running out of time before exams so. (Dean / Sarah agree) (13th Young SAGE gathering, 14th Jan 2018)

In this exchange, Dean and Sarah seemed hesitant in responding to Megan: possibly they did not want to be negative, but they were reluctant to be supportive. Alissa negotiated this tension through a response similar to a 'feedback-sandwich', which is used to encourage improvement in an individual's performance (Parkes *et al.*

2013). In delivering her assessment – instead of following the standard structure of positive reassurance, negative critique, positive comment (Parkes *et al.* 2013) – Alissa initially negatively focused on the time remaining, probably using the Easter break and the following exam period as immovable barriers for extending the project. Then she positively recognised that a small-scale event would be helpful, but swiftly returned to the (negative) notion of time and this being the primary issue. The other participants present supported Alissa's view. With this 'inverse' feedback-sandwich, Alissa succeeded in conveying her opinion without attacking the idea itself, just blaming unfortunate circumstances, and left Megan feeling relatively positive about the conclusion – a benefit of the standard feedback-sandwich method (Parkes *et al.* 2013). Further reflections on how the Young SAGE participants worked together and took up different roles in the project are explored in section 5.2.2.

Further demonstration of owning the project's development was illustrated through the development of ideas that were later discarded. For example, within the third gathering, several themes were discussed (e.g. exploring issues of science in school) before participants decided to focus on young people and interactive science experiences specifically. However, even later in the project there were reversals of earlier suggestions, such as undertaking group interviews with Young SAGE event attendees. Group interview questions were drafted during the eleventh gathering, but were later dropped for reasons I was uncertain about:

> **Emma suggested that the data from the pre- and post-event surveys would be sufficient to answer our main question. However, I'm not sure this is the whole reason. Megan and Mark in particular gave me the impression (through facial expressions) that there was potential discomfort for themselves in carrying these out. (Mark seemed originally to be a big supporter of doing group interviews, so it's interesting to see this development.) (Research diary, 26th Jan 2018)**

Similar to using literature-based excerpts to explore different data-collection tools during the fifth Young SAGE gathering (see section 5.1.1), I wanted to explore the participants' decision without seemingly guiding them into a particular course of

action (Larson *et al.* 2005a). In particular, Mark had originally been a leading proponent of the group interview idea, so I wanted to confirm that this later decision resulted from more than personal discomfort with undertaking the interviews. Consequently, I presented a table of advantages and disadvantages of informal evaluation tools for science events based on Grand and Sardo (2017), the discussion around which was the foundation for participants deciding that a suggestions box – where comments could be made and posted without other attendees seeing – and informal observations would provide complementary information for the survey data. The group interview idea was not reinstated – despite participants recognising the advantages of interviewees feeling supported by peers in discussions on non-sensitive topics (Punch 2002a, Hill 2006) – potentially since event attendees may not have been honest with the event organisers (i.e. the Young SAGE participants) in an interview setting. By using unstructured observations, participants aimed to be more involved with engaging event attendees and thus gain improved insights into their actual experiences. Through encouraging participants to assess the tools to use within their investigation I was able to explore their preferences, but the final decision belonged to the participants.

5.2.2 Participants establishing their roles in the project

The intragenerational dynamics of the group were such that usually a consensus was sought by participants around various project decisions. The first notable example of this collaborative approach occurred during the introductory activity of categorising previous science experiences where participants suggested categories and then decided together where each example should be placed. An approach of posing questions and others responding was frequently used when discussing ideas throughout the project, such as within the fourth Young SAGE gathering where participants developed their nascent project ideas.

As the project developed, so did participants' overall confidence in making decisions, with Megan, Dean and Alissa taking particularly prominent roles. The following excerpt is taken from an exchange regarding a potential event venue:

> **Megan: Okay, so you don't want to enquire about anything else [with the venue]?**
>
> **Dean: The thing is you can spend ages just trying to find another one (Emma: Yeah) that's just as good, and just a bit cheaper, to save a bit of money. But then you waste a lot of time doing that. (Emma: Yeah.)**
>
> **Megan: So you want to message [the venue] and be like can we have this please?**
>
> **Dean: Yeah, I think we should just honestly go for confirmation.**
>
> **Megan: Stuart should do that, cos it's in his name.**
>
> ***[Stuart agreed and requested some details from the participants for the booking form]* (14th Young SAGE gathering, 19th Jan 2018)**

This brief element of a wider discussion illustrates two important elements. Firstly, the use of questioning by Megan to confirm Dean's views (supported by Emma) on proceeding with a particular venue. Several potential venues had been explored previously, and Dean took responsibility for selecting an option. Secondly, Megan's conclusion that it would be my responsibility to take forward this action. In the previous gathering, Alissa had asked if she could use my name as the hiring contact in a venue enquiry, so Megan re-confirmed my venue-liaison role. Here, participants used my position to support their project goals, and just as there is a need for researchers to build rapport with participants (Punch 2002b, Wyness 2009), there is also a requirement for participants to build positive relationships with researchers; they would not have allocated this responsibility to me so easily towards the start of the project. Furthermore, since I had event-management experience and my workplace was funding the project, participants may have wanted to use these dimensions constructively. Also, being a member of University staff could have been regarded by participants as beneficial in venue communications, since the reputation of the University may have been more trustworthy than Young SAGE.

Further exploration of Young SAGE interactions with the wider world is developed in section 5.3.

As the previous excerpt suggests, in addition to collaborative discussions, there were occasions during the project where different participants took on specific leadership roles, reflecting the development of intragenerational power dynamics within the group (Bradbury-Jones and Taylor 2015) with some participants comfortable with leading and others being supportive based on different dimensions such as skills and confidence (Larson *et al.* 2005a). Based on arguments that people take on different roles depending on with whom and what they are interacting (Thomas 2016), it is likely that how individual participants contributed towards the Young SAGE goals would have been influenced by their own personalities and how others (including myself) responded to their inputs. For example, throughout the project, Megan took an active role, volunteering for a number of actions between gatherings. During discussions, she was a more vocal group member and was particularly prominent in the project's early phase, where participants discussed potential focuses for the project:

> **Megan: …we don't have to look at things that are quite experimental like renewable energy, we can try and focus on students as well, because you mentioned industry and I was thinking maybe jobs because - I'm not sure if this is true for most people - but I feel that some people might struggle with you know, how to get - what do you call it? - work experience.**
>
> **Helen: Cos it sounds like you really need work experience, there's no point…**
>
> **Megan: Like we need work experience you know.**
>
> **[…]**
>
> **Megan: All types of kinds of renewable energies [writes on paper]. If you guys want to write on this as and when I'm writing on this that's fine. [Some laughter]**
>
> **[…]**

Megan: Yeah. [3 sec gap] Is there anything that anyone wants to write down for renewable energy? I said it links in with most sciences and it's a current issue that we could look at to tackle, for instance global warming.

Alissa: It's important for young people's futures as well so like everyone can relate to it. [Megan writes] (3rd Young SAGE gathering, 19th Mar 2017)

Megan provided the drive for this discussion: she raised ideas, expanded upon them – sometimes relating to comments from others – and wrote notes to capture the shared points. Within this exchange, Megan also encouraged others to write, potentially signalling that she did not want to dominate the discussion. However, it could also have been a sign of discomfort about the fluidity at this early stage of the collaboration: she wanted to be active, but either felt pressurised by the responsibility or frustrated that other participants seemed to not be equally involved with developing project ideas. However, Megan seemed to become more relaxed with her active role as the project progressed:

Megan: What age group are the activities going to be for shall I say? [5 sec gap] Anyone?

Mark: S1 or S2 isn't it?

[…]

Megan: Shall I say it's an activity day or activity week or something like that? Which is it?

Stuart: It could be either at this stage I suppose.

Emma: Put day, bracket s.

Megan: Okay, yeah that's good.

[…]

Megan: Do we want to be rather convention-sized or a group?

Mark: It depends on what we organise to do for them I guess. How much we get set up and where it is, the venue and everything… [Megan: Yeah.] …and how many people want to come as well.

Megan: Will it be a kind of linear structure to it or will pupils be able to choose where they want to see first? [Exchange of thoughts continues] (5th Young SAGE gathering, 18th June 2017)

In this fifth gathering, Megan still took notes, but she offered her own views less frequently and instead asked more questions to build exchanges based on others' comments. By taking this stance, she still led the discussion topics but became less dominant in sharing her ideas; she still contributed her thoughts, just less frequently. Megan's slight shift in using questions to elicit views could have been influenced by others using this approach during group-wide discussion. Through mirroring this group approach (Larson *et al.* 2005b), Megan became more relaxed in her interactions and less concerned with driving discussion topics.

In contrast, Dean never showed any hesitation in taking a leading role, despite only joining the group in the summer of 2017, over six months after the first group gathering. In contrast to the experience of Ozer *et al.* (2013), this illustrates that leadership roles in young-person groups can be established by new members. Within his first gathering (the seventh overall), Dean seemed to easily fit within the group dynamics, immediately contributing his opinions. Importantly, Dean played a pivotal role in re-energising the group within the pivotal thirteenth gathering and seemed to enjoy his leading role, with progress throughout seemingly quicker when he was present:

Dean: Why don't we make a list of things that we just need to do and then we'll decide how long it will take to do each thing, and work it out from there?

Sarah: If we give ourselves a goal date, it will motivate us to get stuff done, like to get stuff through.

Alissa: the email said the 26th so we could aim for that for now (Emma / Sarah agree).

Sarah: And then if we are lagging behind, once we start organising things, we can always email them back saying sorry for the inconvenience but it's taking longer…

Dean: So what do we need to do before then? What are the things?

Sarah: We were looking at venues last time…

[…]

Dean: So what are the other tasks we need to do? We need to get the survey out. [*Referring to written note.*]

Alissa: Contact the schools with all the information, once we've actually planned it all!

Dean: [Writing on post-it] "Contact the schools."

Alissa: Have you guys made the after-survey?

Dean: Did we do that?

Sarah: I'm pretty sure…

Megan: No we…

Dean: We talked about it at least, I can't remember if we did or not. (13th Young SAGE gathering, 14th Jan 2018)

During this gathering, Dean sought focus by suggesting the production of a priority list with time estimations; he later re-stated this question to re-focus the group. However, within this excerpt he is not the only person asking questions: Alissa requested clarification regarding the post-event survey, a request that Dean quickly supported. So although Dean was the main driver of discussion, he was not alone: Alissa was comfortable with Dean having this leading role, but also felt at ease in seeking clarification when appropriate.

Within this complex dynamic and throughout the remaining part of the project, Dean retained a leading role by posing further questions (such as around requirements for the ethics committee after I had earlier introduced participants to this part of the research process) and focusing on what he considered important. By employing questions in this way, Dean involved others in taking responsibility for the project's progression and it was not just him making executive decisions (except for a decision about the surveys explored in section 5.2.3). Although he did not control every element of the project, Dean's approach and the resultant project

impetus was respected by the others and he achieved a balance between taking a leading role while giving the impression of not feeling pressurised.

The intragenerational relationships of the Young SAGE group were also highlighted through the absence of individuals and the influence this had on those attending. In contrast to peer and conformity pressures that are argued to affect the sharing of views within focus groups involving young people (Gibson 2012), Dean's absence created a decision-making vacuum within the sixteenth gathering when only Alissa, Emma, and Megan were in attendance:

> **Alissa has a strong organisational ethic which positively translated to the progress today. Alissa made several attempts to refocus attention on the priorities – such as asking for input to a draft letter to schools, and asking what we needed to do next as a group. This takes the responsibility from me in keeping the group 'on task' and allows me to make fewer interjections in this regard. (Research diary, 10th Feb 2018)**

Despite not attending since the thirteenth gathering, Alissa assumed a central role and again sought to understand project progress and immediate priorities. Alissa directed some questions towards me, since I was the link with some formal processes (Guillemin and Gillam 2004, Lohmeyer 2019) – like ethics committee applications and agreements with the potential venue. The phrase "…takes the responsibility from me in keeping the group 'on task'…" illustrates how I regarded my role by this stage: participants were leading on discussion topics, but I made contributions through asking questions to maintain focus on group priorities (Larson *et al.* 2005b).

Overall, differing contributions to the group dynamics were made by participants with Megan, Dean, and Alissa having more obvious influences on project discussions over a long period. Other participants made contributions that highlighted specific issues or contributed new ideas (e.g. James' role in early discussions about previous science experiences; Emma's development of the Young SAGE T-shirt artwork), but they only rarely directed the flow of topics. As seen through Alissa's role in the group, the presence or absence of other participants had an influence on how

individuals acted: she assumed a more obvious leadership role in the sixteenth gathering, presumably due to Dean's absence from this discussion. The actions of Young SAGE participants reflects the diversity in how young people exercise their agency (James 2009). As Punch (2016) suggests, agency is not just reflected by obvious actions, taking an seemingly more passive role can highlight how individuals prefer to be involved. For intergenerational engagement with young people then, there is a need to develop relationships over time and for adult researchers to be aware of the various ways in which children and young people can seek to be involved. Some will be interested in taking leadership roles due to greater confidence in working within a specific context or perhaps due to restlessness caused by a lack of tangible progress. Alternatively, some participants will prefer a more contributory role, where they react and support the inputs of others or they take on smaller elements of the wider project where they have more confidence that their skills or experiences have greater relevance and can be more productive.

5.2.3 Respecting the participants' ownership of decisions

Although I presented back participants' ideas from their introductory interviews to assist foster participants' project ownership, there were occasions where I found it difficult to not get too involved in the process echoing the argument that: "[adults] need to steer a course between supporting youth ownership and restrained intervention" (Larson *et al.* 2005a: 179). My aim of working collaboratively with participants should have meant I could offer my views without worrying about being directive, following the approach of Cahill (2007), but I was consistently aware that my adult status could have given my words a more important status (Taft 2015).

Therefore, it took time to find a suitable balance in my interactions with the Young SAGE participants to appropriately respect the participants' project ownership. Within the third gathering, I chose to be more withdrawn – in comparison with the first two gatherings – so participants would have greater discussion between

themselves. However, after their excitable exchanges, I found it challenging to maintain the group's attention at the end of the gathering when I asked specific questions related to their discussions. Thus, my more passive role enabled greater participant interaction, but made me query what my role in the group would become. The tension regarding my role was also commented on by James, as he summarised in our interview when he left the project:

> **Of the key comments for improvements, James wanted to get into the substance of the project sooner – e.g. developing the survey – and that spending some time at the end of one gathering developing an agenda for the next would improve the project by reducing the time wasted on covering the same ground. […] there appeared to be the suggestion that keeping the group on task and providing practical guidance on the possibilities for surveys and the […] event should be elements I bring to the group. In terms of the power dynamics, this suggests that perhaps James looked to me for a central coordination role and more defined parameters. […] James thought there was a little too much freedom in the project so far. (Research diary, 24th Jul 2017)**

From my perspective, there needed to be a great deal of freedom in the earlier part of the project's development. Once the two introductory-style gatherings were completed and the participants and myself more comfortable with discussions, there needed to be a break with the agenda being set only by me. My passive role in the third gathering signified this shift to a more collaborative discussion foundation, but being completely withdrawn from discussions was not beneficial in the longer-term (Larson *et al.* 2005a) so I needed to find a suitable balance. James' idea to discuss priorities at the end of one gathering for the next reinforced sharing responsibility for the project's priorities, whilst offering a sense of structure to our interactions – aligning with some arguments that structure is valuable in participatory projects as long as the potential outcomes remain flexible (Kirby 2004, Cahill 2007, Davis and Smith 2012) – and was consequently an approach that we used frequently.

Yet there were still occasions when the participants looked to me for direction when I did not think my perspective was any more useful than theirs. The following excerpt is from an early discussion regarding which schools to involve in the project:

> **Lisa: …about the surveys, is it just going to be our schools that we're going to be giving the survey to, or is it other schools as well, cos like our school is really bad with telling people about things, so it would help if we were there to also tell the S1s and S2s, "Oh hey, here's a survey, so if you do the survey, you can come along to this science experience…"**
>
> **[…]**
>
> **Stuart: Yeah, so I think that's really coming down to which schools are we going to invite (Lisa: Yeah.) to this, really, any thoughts on that?**
>
> **Lisa: Because it would be easier if it was just the ones we went to, because then we wouldn't have to go up to random schools and say "Hey, you don't know me but." (5th Young SAGE gathering, 18th June 2017)**

Lisa directly appeals to me for guidance regarding the schools that would be involved in the project. In my view, this was a question for the whole group to consider, so I turned the question back around to participants. (On other occasions, I also used facial expressions or gestures to indicate my view that participants should decide.) Within this excerpt, Lisa's instant response suggested that she was not perturbed by my returned question. This action enabled me to retain a supportive position and encourage participants to take further ownership of the project decisions. Nonetheless, project ownership was a negotiable process throughout its duration. Although I explicitly stated that I wanted to support the participants achieve the goals that they set, I needed to act in ways that reinforced my verbal claim. My responsibility for ensuring compliance with formal research processes complicated my status (Lohmeyer 2019) and required participants to occasionally seek guidance from me. However, where I considered that my perspective on a matter was no more important than those of the participants, I sought to encourage further discussion between participants.

Later in the project, I was clearer about my role in the group: I was the group's coordinator, organising gatherings using participants' inputs and ensuring we adhered to research responsibilities and other formal requirements, including health and safety aspects of the event. I also helped participants explore their options. However, I occasionally struggled to avoid intervening, possibly due to my teaching and public engagement experiences where I would be in a role of directing children and young people (cf. Corner 2012). One prominent example concerned a last-minute change in the pre-event survey. Dean transferred the survey from the online Google Forms page (Appendix 17) to a physical paper version (Appendix 18), but in doing so he found that he did not have sufficient space. He therefore deleted a question concerning which subjects participants were considering taking further (and retained the questions about which subjects respondents enjoyed and which subjects they found hardest). I considered this action was problematic, since the group had spent substantial time agreeing on precise questions, and it did not seem appropriate to lose a potentially important question purely due to space issues despite the apparent acceptance of the other participants present in the gathering:

> **However, I don't want to take over control by imposing my opinion on the group. I need to maintain the participative nature of the Young SAGE group and continue to respect their expertise on what works in this project that they have defined and developed. I hope that by offering an alternative paper version of the survey, this is seen as maintaining this respect for the perspectives of participants. I have used their earlier work in developing the online pre-event survey and offered an option that is more faithful to this version. If this action was towards the beginning of the project, then my action of offering an alternative version of the survey could be more easily regarded as imposing a 'correct' version, as I am the 'adult'. I am still the 'adult' now, but I have – in some cases – over a year's worth of interactions with the participants to fall back on, so there is a good chance that my action will be perceived as an offering, a suggestion, and not as correcting their 'mistake'. (Research diary, 20th Jan 2018)**

During gatherings, I utilised questions to explore participants' decisions instead of imposing my view and changing group choices. I also offered ideas for the participants to discuss when there was a pause in discussions. Similarly, I wanted to

explore whether participants agreed with the survey change by offering an alternative that was based on participants' earlier decisions, instead of using questions to scaffold discussions (Larson *et al.* 2005b) or directly stating my opposing view (Cahill 2007). As seen in this excerpt, I may not have shared an alternative survey earlier in the project due to the intergenerational dynamics: my action could have been interpreted as direction, since a disadvantage of the written word is the lack of intonation in conveying meaning. However, since I had worked with the majority of the participants for a year by this point, (hopefully) building positive and respectful relationships (Davis 2011, Davis and Smith 2012, Wyness 2013) that enhanced the trust that participants would have in me (Cuevas-Parra and Tisdall 2019), I judged that my action would be perceived as a suggestion rather than a command, and that I was not criticising their decision.

Within the previous excerpt, the phrase "…maintain the participative nature of the Young SAGE group…" highlights my personal tension in seeking change but also wanting to respect the participants' choice: they originally developed the survey questions and deleting one and risk missing potentially helpful data for the group's research question just due to page formatting was unreasonable in my view. However, there was no ethical issue, so I prioritised the participants' choice over my own opinion. Unfortunately, my offer of an alternative survey (albeit one which included all the questions that participants had agreed) placed participants in a potentially awkward situation, since Dean had already used his version. For her school, Alissa fortunately chose to use Dean's version too, so although I was disappointed that the original complement of questions was not used, I acted in a way that enabled participants to assess the most suitable way forward without compromising their sense of ownership around the project decisions they made.

5.3 Ownership of project in interactions with wider society

Not only could project ownership be considered in the group's intra- and intergenerational dynamics within the group, but also in how we engaged people

beyond our group context. In the remaining part of this chapter, I explore the sense of pride that participants held for their involvement with Young SAGE, and also the sometimes problematic exchanges that took place between participants and adults in wider society.

5.3.1 Participant pride in the project

When some participants were leaving the project in July 2017 due to leaving school, there was enthusiasm amongst the remaining participants to invite other young people as replacements. After James revealed he would leave the project soon, following a group expression of sadness at this news, the following discussion ensued:

> **Megan: Question: if anyone else gets interested in this group, are they allowed to join at all?**
>
> **Jess: No! [General laughter]**
>
> **Emma: Exclusive…**
>
> **Jess: Yeah.**
>
> **Emma: …invite only!**
>
> **Lisa: They have to pay money for pizza, so!**
>
> **Stuart: I haven't said that, nobody can or that it's exclusive from now on. I haven't said that there is a definite shut-off date…**
>
> **[…]**
>
> **Megan: Because I think my friend said she was interested, but I never really talked to her about it since! (4th Young SAGE gathering, 23rd Apr 2017)**

We had not previously discussed any succession plan regarding the replacement of participants leaving the group. In this excerpt, the responses from Jess, Emma, and Lisa to Megan's question about new participants reflected the humorous nature of the group's interactions rather than a protective attitude and an exclusion of others. Following this, the group decided to progress their project ideas further

before beginning to secure new participants. Led by Megan and Mark, suggestions for new participants arguably demonstrated an increasing sense of pride in their Young SAGE association, as well as a greater level of investment in the success of the project, reflecting research elsewhere that suggests some young people value the notion of being involved in research, as well as seeing change as a result of their efforts (Hill *et al.* 2004, Larson *et al.* 2005b). Not only did participants discuss the project between themselves, but some had discussions with peers, and shared information about their involvement in a positive sense. By freely discussing project details, participants indicated their commitment to Young SAGE, as well as a greater sense of ownership.

Additionally, the participants' pride was echoed by their ideas for sharing learning from the project with others. As early as the fourth gathering, I raised the notion of considering how to develop guidance based on the project. This idea received little attention possibly due to participants focusing on the development of project ideas rather than thinking ahead to what could be shared. Therefore, the main attention on sharing our learning took place after the event had happened. However, it was difficult to make progress due to the absence of some survey responses (discussed later in this chapter), as well as the availabilities of participants for gatherings caused by additional work shifts, holidays, and other pre-arranged family commitments. Consequently, I considered putting together my own set of learning points from the project and asking participants to critique these:

> **There have been some things that I have learned about [Public Engagement with Science] with young people from the project and perhaps I shouldn't be silent about these.[31] It is potentially easier for me to see what the new things are – since I am aware of some current practice (especially my own) – and tease out learning points for others. I have key things that we have spoken about […in the post-event discussion and subsequent gatherings…] to suggest that these key points are the basis for the conclusions from the group. I'd rather not do this, since there is a danger of accidently adjusting the tone and emphasis of what participants have previously said, but I would hope**

[31] These learning points are the focus of chapter 6.

> **that the fact that we have worked for such a long time on this project would empower the participants to not just blandly accept what I would write. (Research diary, 23rd Jul 2018)**

This reflection took place four months after the Young SAGE event and I was concerned there would be an unsatisfying conclusion and a lack of advice for others, similar to the position of the FFA (Future Farmers of America) advisors in the study by Larson *et al.* (2005a). Gatherings after the event had limited attendance from participants due to other priorities (Davis 2011, Wilkinson and Wilkinson 2018) – the twentieth gathering was postponed three times due to low availabilities – and consequently I thought it would be difficult for participants to complete their planned reports. I recognised I could produce learning points as a basis for group discussion, but this action risked limiting what the learning points would be as they would initially only come from me and could pre-emptively constrict participants' thoughts. However, given the difficulties in making progress, offering this idea seemed a productive way forward, which participants endorsed by email.

The pride participants felt for the project was reinforced after we discussed my learning points in the twentieth gathering. I had assumed that participants would regard these learning points as a substitute for producing project reports. Instead, Dean and Jess suggested there would be a report about science experiences based on the survey data, and another about the Young SAGE operation aimed at those undertaking similar projects:

> **Dean: … I don't see any reason why we can't do two reports, but then maybe at this stage plan another one… I think actually the planning is the main thing, cos we're more likely to plan it at a gathering and then someone is just going to write it. Maybe. Cos I've got time, I don't mind. But I'll need to know what I'm going to put in it. (20th Young SAGE gathering, 31st Jul 2018)**

Dean's reflections summarise the core issues in completing the reports. As others expressed earlier, a core group of participants needed to lead report-writing based on the inputs of others within gatherings. Although we remained in contact beyond the twentieth gathering, with Megan and Alissa both declaring interest in

continuing with the project, the momentum had finally stalled due to the multitude of other commitments that participants had in the summer after leaving school. Despite the comparatively easier option of using my learning points (the final version – after further interactions with participants – can be found in Figure 9 and Figure 10 in section 6.4), Dean and Jess did not consider that these would be the main output from the project. However, in spite of the participants' pride in the Young SAGE project – especially in terms of running a bespoke event and reflected by participants' project T-shirts (see section 5.1.2) – we were unfortunately unable to produce our main reports as planned.

5.3.2 Tensions in working with other adults to develop the event

From the earliest stages of developing the project, participants assumed responsibility for leading negotiations with schools, there was no suggestion that I should have this responsibility. Participants decided that direct conversation with teachers would be more productive than emails, even when they were considering involving primary schools:

> **Lisa: …would we go in or would like an email to the teachers be more…?**
>
> **Alissa: Well a couple of people should probably go in and be like "Hey, we're here!", you know?**
>
> **Lisa: Yeah, just to get them to understand what we're wanting…**
>
> **Alissa: Yeah, cos we could always divide up and go to our individual primary schools.**
>
> **Jess: Is that primary and secondary schools or?**
>
> **Helen: Because a lot of the secondary school teachers get an email and they're like, "Nah".**
>
> **Lisa: Yeah!**
>
> **Jess: So visit the schools… [Starts writing]**

Emma: I feel that they'd be more likely to do it if they like saw a person. (4th Young SAGE gathering, 23rd Apr 2017)

There was a shared concern that emails would be easily overlooked, and being able to explain the project through in-person discussion would result in greater school engagement. Participants wanting to lead interactions with schools may have stemmed from their pre-existing relationships with teachers: they already knew these people, which provided a foundation for discussions. Thus, the issues of age-segregation (Vanderbeck 2007) could be overcome due to existing relationships. However, in-person discussions did not guarantee school participation. In one school, after a participant introduced the project, a teacher contacted me directly to state their reasons for not being involved. This direct contact could have been a curtesy, since I already knew the teacher, but this action also undermined the participant: they were making arrangements with the school; I was not part of those discussions, but still had a privileged status (Spyrou 2011). Highlighting to young participants in advance that direct adult-to-adult interactions are possible – especially when they already know each other – may help participants to assert their role in the project and ensure that school contacts are aware of appropriate communication routes.

As it transpired, the difficulties experienced by participants in making arrangements with schools led to the original event date being postponed:

Alissa emailed at 10:10am to say that three of the four schools were out - "Turns out we should have communicated more clearly with the schools. To allow 40ish pupils from each school to attend we should have asked for permission weeks in advance. They can't allow the pupils to leave school due to the short notice for parents, teachers and the council. We didn't know it would be so complicated. Is there any way that we could postpone the event so that we can get the all clear from the school? It's vital to all the schools that they can plan their transport, packed lunches, and cover teachers way ahead of time. We have to reconsider all the schools wishes before replanning." (Research diary, 23rd Feb 2018)

The main issue Alissa described was one of notification: school teachers needed more time to prepare. Some writers have highlighted the gatekeeper-status that

teachers have with respect to young people's participation, as they can perceive participation as distracting from the main purpose of learning in schools (Davies *et al.* 2006) and therefore be a bottleneck for opportunities to be made known to young people (Sarre and Moran-Ellis 2014). (However, it should be noted they can be a powerful ally for recruiting children and young people into research as well, see Dockett *et al.* 2013.) Here though, the issue was not completely one of teacher attitudes towards young people's participation, but one of practical school requirements, which could not be overcome in time for the original date. There had been an element of miscommunication too: since mid-January 2018, participants at two schools had been distributing the pre-event survey ahead of the planned event, so the event should not have been a surprise:

> **I had assumed that conversations with the contact teachers had been ongoing for at least two of these schools, but my assumption was wrong and I should have asked about this a little more during our gatherings. I hadn't wanted to for fear of taking over control - making the arrangements with the schools was up to the participants - and I just thought that the participants would have been keeping schools updated anyway, especially as part of the pre-event survey stage. That being said, in the 17th gathering (18th Feb), [participants] from two of the schools seemed quite confident that they would secure their two classes, and this gave some reassurance that some sort of event would happen with these groups anyway. (Research diary, 23rd Feb 2018)**

My initial reaction to Alissa's update was to reflect on my role and to consider whether I should have done anything differently, especially in terms of requesting updates. However, if I had intervened, this would have endangered participant ownership of negotiations with schools. Participants took responsibility for making event and survey arrangements with schools, and therefore they would decide when and how information needed to be shared in the group. Towards the end of the previous excerpt, I recognised this responsibility by reflecting on the confidence some participants portrayed in the previous gathering. I was in no position to question these statements from participants, but still wanted to support them – ideally in a less direct manner than setting deadlines for participants actions as

other adults in intergenerational projects have done (Larson *et al.* 2005a, Åkerström and Brunnberg 2013).

With this news, despite Alissa stating a postponement was required, I encouraged wider consideration of our options including holding the event with the remaining school anyway, holding the event in that school instead, or exploring other participant ideas. Through this response, I intended to encourage participants to think about what they wanted to do next. A postponement might not have achieved anything, since the schools may still have had insufficient time to make the necessary arrangements. I was respecting their ownership of the project's goals, but participants still needed to make progress with teachers to fulfil their plans. The participants' decision was to have a three-week postponement, and despite earlier difficulties around the original date, this decision successfully enabled pupils from two of the four schools to attend.

Although participants were solely responsible for making arrangements with their schools, the demarcation of responsibility with respect to the stall providers became more contentious as the event approached. Initially, Megan took responsibility for communications with potential stall providers (those who would be delivering interactive activities during the event) through the Young SAGE email account, and I provided support by publicising the call for contributions to my professional contacts, as well as encouraging any queries to be sent directly to the Young SAGE contact email. Therefore, I tried to avoid taking a central role in the event's content. However, as section 4.2.2 analyses, the comparative lack of communication with stall providers immediately preceding the event was a personal source of tension due to my event-management preferences and perceived risk to my reputation; I assumed responsibility for being the main contact point for stall providers. Through having this role and being the venue coordinator, I felt I had completely taken over the event management (although I kept participants updated and asked for their inputs) which I assumed would negatively impact the sense of ownership participants had both for the event and the wider

project. However, in the discussion with some participants immediately following the event, they implied that coordinating with stall providers was a low-level contributor to their sense of ownership:

> **Stuart: Now I feel as though sometimes I didn't give you guys enough chance to get involved [in the week leading up to the event], did you see that as a problem or did you see that as a helpful…**
>
> **Sarah: Helpful. Definitely helpful.**
>
> **Dean: If you work for a company and you are organising an event and you come to work together every day, you can discuss it and do it that way. Because we're like so spread out [Emma agrees] and we're trying to communicate and we're all busy at different times, doing different things, at the last minute when there's a few loose ends that need tied up…**
>
> **[…]**
>
> **Dean: I think it would have been different if it had been the date we had originally decided […] as we didn't have any gatherings before the rescheduling aspect, that maybe it was better that you stepped in and were like "I'll do it, I'll tie up the loose ends". [Emma / Sarah agree]**
>
> **Emma: Cos even in the group chat we were not [Sarah laughs] really getting anywhere: "my school's pulling out" "my school can't do this" blah, blah, blah, and everyone was starting to panic, "oh no, it's going terrible". (Post-event discussion, 20th Mar 2018)**

The responses of these participants allayed my concerns that I had taken over their event: their school and work priorities had impeded giving attention to the event. Dean argued, supported by Sarah, that the most important factor was the distant locations of everyone. The participants and myself would have been able to share responsibility for any decisions had we been co-located; a challenge in our age-segregated society (Vanderbeck 2007) – we only had the gatherings in which we could interact face-to-face. This excerpt highlights different perspectives of ownership: the perception that I was tying up '…the loose ends…' aligns with the views of participants developing a Youth Summit in Larson *et al.* (2005b), who suggested that although their adult practitioner undertook a variety of administrative and data analysis tasks, this involvement was regarded as supportive

and did not impinge on their project ownership. In Young SAGE, I was not making any fundamental decisions, just overseeing the final touches. Furthermore, Sarah cut into my developing question, strengthening her view that my action was welcomed. However, at the time of my intervention, there was no request from participants for me to be involved in this way: I had hesitantly offered to update stall providers, an offer which Megan accepted.

Through my offer, I sought participants' permission to assist (Larson *et al.* 2005a) with a task not that they did not want to do (Davis 2009), but one that they were perhaps not confident in addressing. A feeling of uncertainty amongst participants may have affected their confidence in seeking support from me, a position reflected by Emma's comment of panicked statements in the group chat – a forum to which I had no access and therefore I did not have this insight. Participants were not sure how to make progress, especially given the uncertain involvement of schools in the event. In addition, the lack of a Young SAGE gathering shortly ahead of the rearranged event date prevented participants from addressing organisational issues with my support. As Dean reflected, the physical separation of participants and myself limited our ability to explore solutions, especially where tensions arose in making arrangements with other adults beyond our group. The issues related to their statuses as young people operating in an adult-centric society (Punch 2019) was compounded by our lack of an immediate group-wide communication option where we could all exchange views and swiftly achieve consensus.

5.3.3 Challenges in the survey ambitions of the project

The experience of doing the first survey for senior pupils assisted the group in developing subsequent surveys: printed surveys received greater response rates and the consequent time required to input written answers into the Google Forms interface was laborious. Therefore more tick-box options were included in later surveys. Thus, the first-survey data did not make a substantial contribution to the Young SAGE event as planned, but it was a useful piloting exercise:

Dean: It was much more efficient, we actually got it back [in comparison with the post-event survey]! It was just that [the survey for 16-18 year olds] but better [Megan agrees], and more relevant because it was the right age group.

Mark: It would be even more relevant if we actually had something to compare it to. (20th Young SAGE gathering, 31st July 2018)

Mark's comment in the above excerpt neatly summarises the final main issue in the Young SAGE project. We relied on teachers to enable data collection from early secondary school pupils, particularly the post-event surveys since Young SAGE participants had their final exams and were leaving school during this period. Only pupils from two schools attended the event, and there was consequently a small selection of event attendees to potentially complete the surveys.

Unfortunately, we never received any responses.

The majority of attendees were from Dean's and Mark's school, and Dean in particular appeared to devote substantial effort in encouraging his teachers to get the appropriate pupils to complete the surveys:

Dean: …with the first two surveys […] I got the timetables for when [pupils] were in the appropriate classes, so I knew which teachers to give them to, and I said "Here are two lots of the surveys. Can you do them with this class this period and this class this period?" So most teachers had more than one class they had to do it with, [teacher 1] had one! And to be honest he probably did one of the other surveys and managed it fine, […] there were two teachers that came from [Dean's school for the event] […] [and I bumped into teacher 2] in the corridor and said "Oh did you get the surveys done?" And she was like "What are you talking about?" I was like "Did [teacher 1] not give you the surveys to do?" Because there were some from her class and some from his class, and he hadn't even spoken to her about it. And [teacher 1] was like "Yeah, yeah, I'll give it to her." I guess if I was to do it again, I would actually go in to the class and give it to them myself and watch them do it.

[…]

Dean: I think it would have got done if he hadn't have lost them. That was the catalyst for disaster, just him losing them. Maybe because it was digital? But he said he would have printed them off himself, so

that's why I emailed him the first time, so that he could print them off himself, and I even got it up on his computer, and I said "You press print there!" [Both Jess and Stuart laugh] And he said "Okay I'll do that at some point," cos I went to go see him that morning and said "Did you get my email?" (20th Young SAGE gathering, 31st July 2018)

This excerpt covers one of several occasions during the final three gatherings where Dean's persistence in negotiating with the teacher was raised, illustrating his frustration with the lack of action. Despite initially agreeing his teacher would print copies, and then printing copies himself for the teacher to distribute, Dean's tenacity went unrewarded. Dean's passionate and detailed description of his efforts reflected his commitment to the project (Hanauer *et al.* 2012) and his sense of responsibility to make this stage of the project happen (Larson *et al.* 2005b). He did not seek assistance from me or other participants: Dean owned this part of the Young SAGE project and did almost everything he could – except personally administering the post-event surveys – to obtain the data. Given the success of earlier survey distributions, the difficulties around the post-event survey were not easily predicted. Despite taking responsibility for ensuring the post-event surveys were returned and being committed to this task, the contact teacher's inaction could not be overcome. The power dynamics around participants making requests to their teachers – in terms of event arrangements and distributing the surveys – seemed to be an aspect of the project that participants were not expecting to be as problematic:

Dean: So you need to be aware of who you're working with, and be fully prepared [Jess agrees] for the challenges.

Jess: You have to go to extra lengths [Dean agrees], as people may not take you seriously due to the fact that we are youngsters.

Dean: Looking retrospectively we probably should have put the pressure on the teachers and also spoken to them sooner. (20th Young SAGE gathering, 31st Jul 2018)

5.4 Conclusion

Following the previous chapter's look at my positionality within the Young SAGE group, this chapter has shifted focus onto conceptions of participant ownership in addressing intergenerational power dynamics. As Hanauer *et al.* (2012) suggested there are three aspects that can contribute to an individual's sense of ownership – responsibility for the project; commitment to the project; and an emotional connection to the project – all of which are reflected to different degrees within my Young SAGE experience. However, I found that these aspects on their own are insufficient for collaborative intergenerational research: there is also a need to foster participants' sense of ownership to reaffirm that they are not simply working towards a pre-determined, adult-generated plan. I needed to confront the participants' expectation of being directed in this project (Punch 2002b).

Therefore, at an early stage, I reinforced my collaborative message within the Young SAGE project through my actions (Kirby 2004), since in addition to being the only adult, I was also the convenor of the group and provider of the initial broad project outline. Encouraging participants to have a greater stake in Young SAGE involved a variety of subtle intergenerational interactions (Davis 2009, cf. Åkerström and Brunnberg 2013), such as sharing responsibility for basic group decisions (see Kirby 2004), e.g. date of the next gathering, as well as more advanced ideas, such as whether training was required – a topic of some debate in childhood research (e.g. Cahill 2007, Kim 2016). By involving participants in these decisions, I still had a perspective on what actions we could take, but I tried not to avoid prioritising my view above those of participants. This approach was also highlighted by how we dealt with the period of slow progress ahead of the thirteenth gathering. After brief consideration of alternatives, the group's recommitment to the original plan reinforced their project ownership. Their emotional connections to the project (Wiley 2009) – as a novel undertaking in which they had invested significant time – may have also contributed to participants' drive to complete the project plan. This

drive is further illustrated by Dean's passionate frustration with the post-event surveys not being completed by his school.

Prior to the start of the project, I assumed that for participants to feel ownership, they would need to directly develop all aspects of the project's identity, including creating the name and logo. In this project, I was wrong; participants rejected the option of developing their own, and instead actively adopted these elements of the project. The participants' actions illustrate how the concept of ownership is personal and supports the view that participants do not need to develop everything from first principles (Ozer *et al.* 2013), as long as they have an affinity for the project's overall purpose, which Young SAGE participants demonstrated by using the name and logo in future references to the project. The development of participant ownership was also reflected by shifts over time in participants' pronoun use (Hanauer *et al.* 2012) in referring to the project: 'your' became 'we' and 'our'.

Within the confines of the group, the participants and I achieved positive and respectful relationships that destabilised the normative adult-child dynamic and enabled genuine collaboration (Davis 2011, Mayall 2012, Wyness 2013), as reflected by participants' enthusiasm to engage other young people in the project and to develop guidance based on our research. However, in engaging other adults, the normative relationships between adults and young people remained, especially when adults were unknown to participants. In contrast with ongoing interactions with their school teachers, participants lacked a prior relationship with the stall providers, which potentially contributed to a lower level of confidence – and consequent delay – in making arrangements with these unfamiliar adults (see Punch 2002b, Vanderbeck 2007). My fear that taking over the liaison with stall providers would reduce the sense of participant ownership of the project was misplaced, mirroring the comments made about Jason's collaborative actions in Larson *et al.* (2005b): my role was seen as merely supportive, especially as it turned into a purely administrative task since there was no selection of content.

The tension around the stall-provider liaison role highlights the differing perspectives on ownership of those involved: whereas I regarded it necessary for participants to be involved in as many actions as possible, participants did not have the same criteria. From my perspective, I focused on the change in allocation of responsibility – participants were originally liaising with stall providers, but I had 'taken' the role by asking permission (Larson *et al.* 2005b) – and it was this perception of 'taking' that caused my tension. This distinction illustrates how I was not always successful in being prepared for all eventualities in the time-pressured confines of real-world interactions. As a researcher collaborating with project participants, it is not always possible to envisage how they perceive the choices made during a collaboration and therefore establishing respectful and open avenues of communication are vital. (Our respectful relationships were also illustrated by how we dealt with the survey change in 5.3.3: I felt I had to question the last-minute change without imposing my view, which participants considered and made a choice on how to proceed.) When an adult researcher works with any marginalised group – like young people but not exclusively – that interacts with wider society during a project, differences in perception are possible and arguably likely. Although my research has illustrated the possibility to reduce power inequalities within a group's dynamics, there are normative relationships beyond the confines of the immediate group that will remain relatively unaffected (see Montgomery 2009).

As a final reflection, the power dynamics did not only apply to me and the participants, but also between participants. Once they had agreed the broad outline of the collaborative project based on their original ideas, the group's intragenerational relationships became increasingly prominent (Bradbury-Jones and Taylor 2015). Some participants were seemingly content to take supportive roles, while others – Megan, Dean, and Alissa – took more leading roles at different stages and in contrasting ways as I've previously discussed. These differing levels of influence emphasise the agential statuses of participants in choosing how actively they wanted to contribute (James 2009, Punch 2016) and presumably extend from

participants' individual personalities: the relative confidence levels in our (new) Young SAGE context will have influenced how individual participants engaged with others (and with me). Dean and Alissa demonstrated greater confidence in working with new people, and therefore assumed leadership roles more easily in comparison with other participants, whereas others were happier to contribute as the project developed.

6 Perspectives on, and insights into, public engagement with science: the dimensions and purposes valued by young people

In the previous two chapters, I have presented and discussed the complexity of undertaking a collaborative research project with a group of young people, in which I addressed intergenerational power dynamics by paying attention to notions of project ownership.

Based on this collaboration, I now turn to explore young people's perspectives about public engagement with science activities, a topic that has been substantially overlooked, except for the brief inclusion of young people's opinions in research on specific communication-based events (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015). By avoiding the sole focus on learning that Stocklmayer *et al.* (2010) employ in their review of informal science experiences, I was able to explore participants' preferences across all modes of public engagement: communication, consultation, and participation (Science for All 2010). Furthermore, by taking a collaborative approach I prevented limiting my exploration, contrasting with predominantly survey-based approaches taken by others when studying young people's science aspirations (e.g. Bennett and Hogarth 2009, Aschbacher *et al.* 2010, Archer *et al.* 2013).

In this chapter, I initially advance ideas around the dimensions of science experiences that are more important for young people. Later, I draw attention to the main purposes of science experiences – learning, sparking interests, and inspiring future choices – for young people, and address the minimal focus on experiences that seek the contributory expertise of young people.

As already discussed, we suffered difficulties with the surveys related to the Young SAGE event, but the open nature of the project has resulted in rich data from the participants in terms of their own science experiences, both past and desired, as

well as their reflections on the Young SAGE project, which are all critical for the analysis I have undertaken. Thus, the minimal data from event attendees is not important, but the perspectives of the Young SAGE participants is crucial for what comes next.

6.1 Dimensions of science experiences that affect the appeal for young people

In this section, I explore the dimensions of science experiences that were important in reflections shared by Young SAGE participants. I begin by focusing on aspects that can be considered as gateways: the baseline conditions that are required for an experience to begin to appeal (e.g. interesting topic, convenient, accessible, novel). From this basis, I then discuss other dimensions that affect the value of particular experiences: authenticity[32], entertainment, personal connection, interactivity, and the scope of independence.

6.1.1 Interest in topics rather than broad subjects

Regarding the sciences as purely a combination of biology, chemistry, and physics – as frequently defined in UK school systems (Tlili *et al.* 2006, Bennett and Hogarth 2009) – unhelpfully obscures the diversity of topics within each. In reflecting on her subject choices in early secondary school, Sarah suggested that links between different sciences should have been clearer instead of conceptualising science subjects as completely distinct:

> **Sarah: [In first year at secondary school] I really didn't like physics and chemistry believe it or not, I only liked biology as it made the most sense. […] …and people do say it's good to have one or two sciences and I was like "Oh I'll just take chemistry" so it was more I'll take it because I kind of have to take it. But if I just knew like how interesting**

[32] For clarity, the use of 'authenticity' here is to reflect the term 'genuine' rather than evoke arguments around the search for the 'authentic' children's voice, disparaged due to its implication that there is a singular voice (that obscures the diversity of children and childhoods) which is context-independent (Connolly 2008).

chemistry was or how interesting physics was, cos I'm looking back at it now and I kind of wish I did physics …

[…]

Stuart: And what do you think would have helped you?

[…]

Sarah: …if somebody was to tell me that of course physics isn't just only this aspect, but also this aspect it also links in with chemistry, or links in with biology, I would have probably been open to the idea of doing physics. (Sarah interview, 5th Sept 2017)

By only considering science as being comprised of three core subjects, there is an issue around expectations on the focus of each subject. For Sarah, the topics within these broader subject boundaries seemed more important, which was also supported by Alissa's reflections on studying esters in a recent chemistry unit as being a particularly interesting topic. Focusing on specific topics within public engagement rather than entire subjects supports arguments made elsewhere (Bathgate *et al.* 2014), especially in avoiding subject-related stereotypes (Stocklmayer *et al.* 2010). It is the nature of the precise topics themselves, rather than the overall subjects, that are important; it is too simplistic to consider that an individual will like (or dislike) all physics topics for example. For those engaging young people with science concepts suggesting how different topics interrelate and transcend traditional science subject divides could be a potentially valuable angle for engagement activity: a theme-based approach – e.g. climate change – could be the foundation for including relevant science concepts.

6.1.2 Convenience and accessibility as distinct dimensions

Since my research took place in a city which has hosted a prominent science festival for many years, coupled with the general recent growth in the popularity of science festivals internationally (Bultitude *et al.* 2011), it was not surprising that several participants shared experiences from the local science festival. In one sense, this breadth of similar experiences emphasises the role of convenience in enabling

engagement. However, despite the close physical proximity, some participants had never attended a local science festival event, implying that other factors are influential even for the Young SAGE participants who were all clearly interested in various scientific topics. Accessing festival experiences appeared to be enhanced by parental involvement (DeWitt *et al.* 2014) in some cases, but not exclusively: for Emma and Alissa, their visits to the science festival had been at a relatively young age and instigated by their schools, whereas Jess' visits had been with family members more recently. Amongst science experiences, science festivals were regarded as one of the most accessible by participants (contrasting with other research, such as Dawson 2018, Kennedy *et al.* 2018) as Jess reflected in the second Young SAGE gathering:

> **Yeah, just easy to get to, easy for us to get ourselves involved with […] a lot of the science festival things are free, so you can just turn up and do what you want to do, whereas work experience, your science baccalaureate[33] and your CanSat[34] projects have to take a lot more time and effort to try and get involved with them and you've got to sign up and put a lot more time and effort into doing it whereas something at the science festival, and the YouTube [videos] you can just do if you've got a day to spare. (Jess, 2nd Young SAGE gathering)**

As Jess summarised, science festivals involve an element of choice for attendees – a theme returned to later in this chapter – and also do not require payment for access. Therefore, although the location increases the convenience of attending, payment is implied to be a potential accessibility barrier, which the local science festival had seemingly avoided by removing the cost for attendance for many events. Although not regarded as an issue for Jess, attendance costs can be problematic for others (Kennedy *et al.* 2018). Research involving adults with low incomes and minority ethnic backgrounds reveal they could not prioritise visits to science festivals or museums since they would be losing income through missing work-shifts (Dawson 2018), an issue that could apply to other young people, especially those who combine education with weekend/holiday work.

[33] https://www.sqa.org.uk/sqa/42884.html
[34] https://www.esa.int/Education/CanSat/What_is_a_CanSat

Reflecting the growth in digital engagement with science (Stilgoe *et al.* 2014), online citizen science was another science experience identified by participants as being amongst the most accessible. However, Mark was the only participant who raised his own personal experience of an online citizen science activity during the introductory interviews. This suggests that either the experience format itself was not sufficiently interesting to engage the majority, or that participants did not feel that the format was worth discussing. Once again, there is a distinction between convenience and accessibility: all participants had access to the internet, but most did not engage sufficiently with online citizen science to warrant attention in our introductory discussions, if they had had this experience at all. At best, there appeared to be a lack of enthusiasm for this format, at worst, a lack of interest. This relative paucity of positive engagement amongst participants could relate to personal preferences around this format, but also the preferred purposes for engagement by individuals, the latter of which is explored in a later section. Irrespective, this lack of enthusiasm offers a note of caution around recommendations aimed at museums to expand their efforts to engage through online channels, as recommended by Mujtaba *et al.* (2018), in terms of whether their desired audiences could actually be reached.

Within his own experience, Mark had to identify things within images of the Universe in a project called Galaxy Zoo[35] and in doing so assisted the research process. Initially, Mark was keen to contribute but his interest soon waned:

> **I used to do [Galaxy Zoo] a little bit and then I got lots of spam emails so I stopped. […] I did start doing it quite a lot and then I just slowly petered out […] it was just lots and lots of photos that looked the same […] I was in school when I was doing it and then when I turned to the school holidays I just got out of the routine and then I never started doing it again. (Mark interview, 11th Jan 2017)**

The possibility to contribute to the research process might have been a motivation for Mark in the beginning, especially in a topic that related to his strong interest in

[35] https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/

space, but this spark was extinguished by the lack of positive feedback, the lack of variety, as well as receiving spam emails. There was no obvious reward for his efforts, only more similar-looking images to which to respond. It seemed that the novelty of the experience appealed to Mark at first, but his interest was not sustained by the monotony of the identification process.

6.1.3 How novelty can enhance and disrupt experiences

The novelty of an experience was also discussed in relation to other science experiences. The initial exposure of Young SAGE participants to the idea of 'science' varied, with a particular focus on primary school experiences:

> **At primary school we never got anything to do with science […] all we did was maths, English, your arts and your sort of languages, which you started in P6 but before coming up to high school I had my first science lesson, I thought "Ah, this is great! How have I not seen this sort of thing before?!" I'd never even sort of envisaged a science class. Now I'd been to exhibitions and stuff with my parents, but I'd never actually been in a classroom getting taught science... (Jess, 2nd Young SAGE gathering, 5th Feb 2017)**

Jess reported that science was missing from her primary school education, a notion supported by there being less regular science teaching in Scotland's schools compared to the rest of the UK (see Leonardi *et al.* 2017). Although she had some exposure to science through other experiences, the impact of Jess' first science lesson was evidently extremely positive. Contributing to the sense of novelty (see Boeve-de Pauw *et al.* 2018 for an out-of-school focus on how novelty can have positive or negative impacts) could have been the unusual nature of the room. From my own school experience, primary schools do not generally have dedicated laboratory spaces, whereas most (if not all) secondary schools do. The unique nature of the space may have made this experience more memorable for Jess and enhanced her first exposure to school-based science.

The suggestion of a lack of science in primary school was supported in the third gathering: "You don't get to do science properly until first year [in secondary

school]" (Helen, 3rd Young SAGE gathering, 19th Mar 2017). The term 'properly' is important. Although some participants raised topics taught in primary schools (e.g. planets), there were criticisms that these focused on other angles (e.g. making papier-mâché planets) rather than the science itself. This reflection suggests some potential limitation around novelty for learning experiences: if there is too much novelty, then the experience is overwhelming and the cognitive benefits reduced (Boeve-de Pauw *et al.* 2018).

Science in school was not the only experience in which the notion of novelty was raised; the novelty of school field trips can also provoke strong affective responses (DeWitt and Storksdieck 2008). Alissa's visit to the science festival – facilitated by a primary school teacher – was the source of a powerful memory several years later in her introductory interview:

> **…it's where I first remember loving what I was doing; it was the first time we'd actually been taken somewhere and were taught about something outside of just a school trip. (Alissa interview, 9th Dec 2016)**

The impact of the event seemed to be enhanced by being something different from the usual day-in, day-out school routine and struck an appropriate balance so that Alissa was not overwhelmed by the experience, which would have limited the impact (see Boeve-de Pauw *et al.* 2018). The novel nature of the event, alongside the appealing content, appeared to have contributed to Alissa's continuing interest in science from a reasonably young age.

6.1.4 Authenticity of science experiences

The authentic nature of an experience was highlighted by several participants as an enhancing aspect. Megan, for example, recalled a science-festival visit where she engaged with a computer simulation of a model dinosaur in which she changed certain parameters and saw the impact on how the dinosaur walked on screen. Physically doing the activity was just one part of the experience, an equally

important part for Megan was the opportunity for discussion directly with a researcher:

> **…one guy was talking to me about AI [Artificial Intelligence], and […] he didn't really believe that AI was a thing, right, he was giving me his point of view and he was like computers are idiots – which they are – and they can't really think for themselves, but on the other hand, you know, people would believe AI […] If you give [computers] a piece of information, they will learn from that piece of information and maybe expand on it and stuff like that, but there's a bit of conflict between people in science and I found that quite interesting as well. (Megan interview, 16th Nov 2016)**

Beyond the basic scientific content – i.e. what happened within the dinosaur simulation after changing the software inputs – the process of science itself engaged Megan. Being able to have a conversation directly with a researcher – which Stocklmayer *et al.* (2010) argue enhances the importance of the science experience – provided the chance for Megan to look 'behind the scenes' of how science operates and gain an appreciation of the debates from someone who is involved with that process himself. The experience was more than just doing the activity, but also finding out about the actual practice of science.

As well as accessing cutting-edge science, this experience from several years ago had a longer-term impact on Megan. The dinosaur simulation was one activity amongst several others in the venue, but Megan had forgotten what these other activities were. There could be some significance to this recall: it could have been that the dinosaur simulation was the origin of Megan's interest in computing, or it could have been that this experience further developed an existing interest. In either case, the memory stuck with Megan, arguably playing a role in her later interest in this branch of the sciences. Potentially, the authenticity of the interaction with a genuine practising scientist may have enriched the experience further.

The idea of authenticity was an important contributor to several participants' visits to prominent scientific sites, such as NASA and CERN. Dean's enthusiastic

description of his visit to the site of CERN certainly reflected his strong interest in the sciences, particularly physics:

> **…actually go and see where physics is being done in the world to find things out is […], I guess is like a pilgrimage! […] the holy site of physics. (Dean interview, 7th Jul 2017)**

Dean's religion-invoking description emphasises his feelings of joy and important impact of him being in the actual place where the Higgs Boson discovery was announced in 2012; a discovery that resulted in significant worldwide media attention in its wake and, in 2013, a Nobel Prize[36]. Dean's passionate summary reflected this pinnacle moment, a moment that was very unlikely to be forgotten and one he was openly proud of, "…now I can say I've been" (Dean interview, 7th Jul 2017). Similarly, for Alissa, visiting NASA was:

> **…a once-in-a-lifetime thing, like you don't like just go to NASA everyday… (Alissa interview, 9th Dec 2016).**

So not only is contact with current scientists an important dimension for young people in enhancing their experiences (Stocklmayer *et al.* 2010), visiting authentic (and unique) nature scientific places – as well as being novel due to being 'once-in-a-lifetime' occasions – can also contribute to participants' powerful memories and emotive reactions.

6.1.5 Entertainment and personal connections

The role of the presenter(s) in science lectures and science broadcasts (e.g. TV programmes, YouTube videos, etc.) can significantly influence an experience's value, as Dean described in his recollection about a recent university physics event:

> **Dean: …it was really engaging and really funny! I didn't expect that! But it was really really really funny. [The speaker] was just so charismatic and coming up with all these jokes, and it was, you didn't want it to end, so. […] [It was the] absolute best bit, yeah.**

[36] https://www.nobelprize.org/prizes/physics/2013/summary/

[…]

Stuart: And was it because of the guy himself who was doing the talk or was it…?

Dean: I'd say it was, but I'm pretty sure I've said this before, it comes back to there's a connection when somebody else is as excited as you are about anything, well I'm sure it's the same about anything, but be excited about physics if somebody else is excited about physics it can be really nice, yeah, and it was just funny. Easy to listen, you wouldn't fall asleep. […] Yeah he's very engaging. (Dean interview, 7th July 2017)

Humour was clearly key for Dean, who already had a strong interest in physics and may have been content in just simply learning more, but the style of delivery clearly improved the overall impact on him. The use of humour to engage young people is also highlighted by participants' suggestions for health education campaigns (Stafford *et al.* 2003), and reflected by young participants in O'Brien and Moules (2007) through their job description for a research officer to work with them. Furthermore, there was an element of identifying with the speaker, which was also important for Mark in his ongoing engagement with the VSauce YouTube channel. In Dean's example, he was further inspired by the enthusiasm of the speaker, and not just the lecture content, a view supported by Mark in his recollection of a different public talk:

I went to see Brian Cox do a lecture […] That was really good. That was with Robin Ince and it was a comedy, but also it was just science, it was just physics, […] he went into lots of detail and it was really interesting. […] I just really like Brian Cox. […] he's so enthusiastic and you can tell he really really loves [science] and knows what he's talking about and it just makes you feel like 'Wow! That's really cool.' […] I just love hearing him talk. (Mark interview, 11th Jan 2017)

Humour again was a positive factor, but it was also the perception of Brian Cox as someone who really enjoyed and was passionate about the physics topics under discussion that added to Mark's enjoyment. Given his background of appearing in documentaries for national TV, Brian Cox could be regarded as a science expert and this seemed to be the case for Mark, since he '…knows what he's talking about…'. This granted Brian Cox an additional layer of gravitas and again enhanced the

impact on this participant, which supports claims made elsewhere about the positivity of visitors to talks given by perceived 'experts' (Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015).

For young people, identifying with the speaker can arguably inspire greater engagement. When discussing her own science-experience ambitions, Sarah wanted to engage and inspire children through a show – partly for her own enjoyment, but also to address a perceived lack of science teaching at that level. Sarah highlighted the importance of the person's identity in reinforcing aspirations by being someone that young people could see themselves becoming in the near future, and potentially challenging the stereotype that science is difficult noted elsewhere (Bennett and Hogarth 2009, DeWitt *et al.* 2014):

> **I mean [the primary school pupils] would probably see somebody in their 40s and be like "They've probably just studied science for ages in University, blah blah blah" and find that a really boring career to get where they are now, well if they see a young person they will be like "Oh actually to be that level, to have that kind of level of chemical experience or whatever at such a young age, I mean that seems more attainable…"**
>
> **So for example like if you go to the doctors and see a 40-year-old doctor you'll say "Oh he's had years of experience, he's probably been a GP since he was young", but if you see a young doctor "oh actually wow, she's probably just out of university, she seems like she's having a good time being a GP", you know it seems like […] a more attainable career if you see people your kind of age doing something. (Sarah interview, 5th Sept 2017)**

For Sarah, being relatable seemed important for encouraging further engagement: the relatively young age of the presenter implies that considerable experience is not required in order to achieve the same abilities. Sarah supported her argument by suggesting a younger fictional doctor would make pursuing a medical career more realistic for young people due to the smaller age difference. (It would be perhaps concerning for some – such as my 39-year old self – to see the old-young divide being around 40-years old…) Sarah's ideas support the notion that who tells the story of science on TV affects the impact on viewers (Dhingra 2006), and – in this

scenario – contrasts with the assertion that the authenticity of engagement with practising scientists is positive (Stocklmayer *et al.* 2010): being a younger and therefore more relatable person (potentially a role model) could make the experience more impactful on the younger audience; in contrast to other research (Aschbacher *et al.* 2010, Archer *et al.* 2018), it's not only influences from the family and schools that impact on young people.

Having a personal connection does not solely apply to the speaker-listener dynamic: there can also be social connections with other attendees at an experience. Dean attended a week-long space-school programme involving talks and interactive activities for around 100 late-secondary school pupils. A big advantage of this programme for Dean was the interaction with those who had similar interests:

> **And it was nice to be surrounded by like 100 other people who were interested in the same sorts of things as me and we could chat about stuff and not really get bored… (Dean interview, 7th Jul 2017)**

The shared interests in the core concepts at the heart of the programme appeared to be an additional positive for Dean, particularly from a social angle (Stocklmayer *et al.* 2010), since it provided common ground from which to begin to get to know new people. This aligns with Kustatscher's (2015: 222) summary of Yuval-Davis: "People can 'belong' to individual persons or groups, in abstract or concrete ways, and through processes of self-identification or identification by others." In Dean's summer school, involving a variety of different talks and interactive workshops, the common thread of identifying with other participants (not only 'presenters') – and presumably other attendees reacting similarly from their own perspectives – contributed to the positivity of the overall event.

6.1.6 Contrasting views on interactivity

Being interactive is a concept that generally relates to hands-on exhibits (such as in museums, see Mujtaba *et al.* 2018), and are generally thought to be the most suitable way to engage children, despite some queries about their impacts on

learning (Bathgate *et al.* 2014). The attractiveness of interactivity is illustrated by Laura's regret around the lack of practical experiences in her biology lessons:

> **I think I would have liked to do more practical things relating to the courses that I do, […] So I think to put into practice what we're learning in school […] will make me more interested and […] I think make quite a lot of people more interested in it, because it's like seeing what you're learning and all the theory and it's putting it into something tangible and something you can see. (Laura interview, 18th Nov 2016)**

An additional element of practical activities is the contextualisation of otherwise abstract scientific ideas. Laura's opinion resonated with many views from other Young SAGE participants regarding school-based science: having more practical, hands-on experiences would increase the relevance of more abstract dimensions of the courses, which aligns with previous studies (Stocklmayer *et al.* 2010, Bathgate *et al.* 2014). For science festivals, providing interactive experiences is a key element of the overall programme (Bultitude *et al.* 2011, Jensen and Buckley 2014). For Young SAGE participants who had been to the local science festival, the interactive element appeared to be a strong part of its appeal, as Megan summarised during group discussion in the second gathering:

> **…you can actually do experiments and you can actually get involved with simple to kind of moderately levelled experiments… (Megan, 2nd Young SAGE gathering, 5th Feb 2017)**

The notion of being active is emphasised by Megan's use of 'do' and 'involved' within this single sentence, with the activity level aiming to encourage engagement with those who would not be particularly adept otherwise. However, hands-on activities did not have universal endorsement within the Young SAGE group:

> **Mark: …if it's an activity to engage young people at a festival or something it's just going to be better if it's all interactive because if I was at a science festival and there was a bit where you just went and sat down and listened to a guy or there was a thing where you got to go over and actually like do stuff, I'd go to the thing where you actually do stuff.**

Jess: I think I would have been more of the sit and listen type of person…

Mark: Really? *[Surprised]*

[…]

Jess: I feel like, because I was quite shy as a child, like I didn't want to put myself out there so if they had an event where you could sit and listen but then watch things getting done, I would have been in my element, whereas getting hands-on for me I wouldn't have enjoyed it as much, that's why I think you need a mix of both to cater for everybody. (20th Young SAGE gathering, 31st July 2018)

The preferences of an individual are highlighted in Jess' rebuttal: her tendency to not want to stand out would have inhibited her in the unusual science-festival setting. She wanted to observe, and not be in the limelight. The participants present in the above discussion further reflected that the setting has a substantial role to play: a school-based scenario would be better – for these participants – since they would be with people they knew and who gave them greater confidence, reflecting suggestions elsewhere that enable shy young people to be involved in research with adults (Mayall 2000, Stafford *et al.* 2003, Christensen 2004). However, the participants themselves highlighted that 'a mix of both' is required to appeal to different preferences: there is not a one-size-fits-all – young people are a diverse collective with many individual characteristics, even with this small group of people who are all interested in the sciences.

Elsewhere, the interactivity of online broadcasts is argued to make a positive contribution as the user can choose how to consume and engage with the content (Stocklmayer *et al.* 2010), however this perspective was critiqued by participants during the second Young SAGE gathering:

Mark: …I don't do it but quite a lot of people send [YouTube content creators] messages and then they respond to the messages with another video explaining something if you don't understand so if you choose to interact with the people on the Internet, they quite often do respond but you don't have to.

Megan: There's no guarantee they'll respond though.

Mark: Well with the big channels, they generally do.

Megan: Maybe.

Mark: And give you resources to find out for yourself as well if you want to.

[…]

Megan: They can click other channels, they can just send out anything and don't really respond to their fan base! (2nd Young SAGE gathering, 5th Feb 2017)

The exchange of views between Mark and Megan provided two contrasting positions. Mark was more positive about how YouTube comment boards enabled access to further content on request, appearing to use this as a form of entertainment (like Regan in Beckman *et al.* 2019). Megan, on the other hand, argued that content suppliers spent little time or effort responding to their viewers. The disparate nature of these views may be related to the precise nature of the channels with which these participants have engaged: Mark was consistently positive about specific YouTube channels (e.g. VSauce), particularly with the quality of content production. However, Megan might have been reflecting on poorer-quality channels that have not operated in the same way. Alternatively, the format may not have been sufficiently engaging for Megan: she spoke enthusiastically about the physical interactivity available through science festivals and computer coding, so the interactivity of YouTube message boards may not have held the same appeal.

6.1.7 Independence within more-involved experiences

When discussing more-involved examples of science experiences (e.g. competitions, supported research projects, science baccalaureate, etc.), Young SAGE participants suggested that individuals needed more background knowledge to successfully engage, which therefore made the experiences less accessible than others (e.g. science festivals and science broadcasts). However, knowledge on its own was

insufficient, since the inner-drive of the individual was also important, as Helen revealed through her reflection on a zoo research project:

> **Yeah, you actually have to like want to do [the experience], you have to be quite motivated! (2nd Young SAGE gathering, 5th Feb 2017)**

This motivation would be necessary since these types of science experiences involved a greater level of independence. As Helen described, the zoo research projects were not directed workshops where participants followed pre-determined steps. Instead, those involved had to work together without having a 'correct' answer to achieve:

> **[The zoo research project] is very self-led, so we don't get much guidance with it which in a way is good, but none of us have ever done it before, so it is quite difficult trying to work out whether this hypothesis would work or if this method of research is going to suit what we're trying to do. So it's quite difficult working at it but I think it is good and it will pay off yeah. (Helen interview, 28th Nov 2016)**

Within the structure, there was a degree of freedom for project participants to plan investigations collaboratively (although both Helen and Lisa remarked that zoo staff gave feedback on suggestions to prevent impossible plans). This flexible working approach, although challenging, was enjoyable for Helen: the experience of tackling an open-ended investigation, with the demands on decision-making this would entail, would develop her scientific skills further and be a useful experience for her future medicine-related ambitions. Although collaborative, the sources of motivation appear to be emanate from the individual, and not be externally driven (e.g. peer recognition of an individual being good at something, like Joseph's artistic talent in Aschbacher *et al.* 2010): the participants here illustrate their internal enthusiasm for the experience.

In a similar way, the science baccalaureate approach was self-led, but both Rory and Luis were in sole charge of their projects. They both suggested that the time taken to progress their projects was a negative, although – just as Helen reflected on her research project – Rory and Luis seemed to really relish the challenge:

> **…the time is the only thing that's […] the only real negative. I'd say the rest of it I quite enjoy, especially because it's something you've chosen. You're obviously going to be interested in it, so it's not the same as being given a random subject to go and research it, which comes across sort of as a task and a struggle. (Luis interview, 17th Nov 2016)**

Luis' swift change from focusing negatively on time was quite revealing: the enjoyment of undertaking independent study outweighed the time commitment. For example, elsewhere in our discussion, he spoke very enthusiastically about his project and the contacts he had had to make with people in universities and industry. The challenges set by the independent nature of the competitions, zoo research projects and science baccalaureates within Young SAGE participants' accounts, instigated substantial engagement and enabled participants to build upon their individual knowledges and interests. This idea of challenge instigating greater engagement with science topics has also been seen in young children (~5-6 years old, Hall and Schaverien 2001). Within the above excerpt, Luis favourably compared the freedom of the baccalaureate against the struggle of trying to complete a given task, which Rory also reflected on:

> **…I've got to a kind of point in school life anyway which, where that I think I quite enjoy that [freedom] now. And I wouldn't say get bored of school but would just say that you get into a process and it's very easy to stick, to get into a rut… (Rory interview, 17th Nov 2016)**

The novelty of the baccalaureate as different but not overwhelming (Boeve-de Pauw *et al.* 2018), combined with the possibility to explore his own science-related interests, distinguished the science baccalaureate from school-based science investigations where a pre-determined goal was already in place. Rory was somewhat jaded with the usual mechanics of school-based science and welcomed the responsibility to pursue his own interests. This independence shift may not be welcomed or required by every young person, but it reinforces the suggestion that a diversity of approaches is needed to avoid discouraging those engaged through repetitive, monotonous experiences.

6.1.8 Discussion

The different science experiences in this section have illustrated that the specific format of engagement (i.e. science lecture, online citizen science, competition, science festival activities) is arguably not as important as the dimensions related to them. Even within the small group of participants involved in the Young SAGE project, these dimensions (e.g. convenience, novelty, interactivity, etc.) influence individual's opinions and perceptions of different exercises, which can therefore raise contrasting views on the same format, such as the exchange where Megan was far more critical of the interactive capacity of online broadcasts in comparison with Mark.

Particular topics at the heart of the engagement can spark an interest, which can then motivate individuals to seek further novel, authentic, and entertaining experiences to enable the spark to flourish. However, in contrast with the perspective taken by Archer *et al.* (2018), the responsibility for engaging young people with various experiences is not the sole responsibility of adults. Jess' interest in architecture, James' engineering focus, Megan's fascination with computing, and Dean's and Mark's attraction to space and physics all formed the foundations for them to seek out further relevant experiences that would appeal to these interests and their own engagement preferences. Entertainment – and therefore enjoyment – were consistently positive markers and confirmed elsewhere as an important part of (particularly informal) science experiences (Burns *et al.* 2003, Tlili *et al.* 2006, Stocklmayer *et al.* 2010). However, how this enjoyment was enhanced would not be achieved in the same way for each participant. Jess, for example, was not keen on interactive experiences in comparison with other participants: books, TV documentaries, and science lectures – experiences where she could take in information – enabled her to advance her architecture interest.

In addition, particularly for experiences beyond an introductory level, the independence to pursue unique projects (e.g. zoo research, science baccalaureate, competitions) enhanced several participants' motivation to engage. Although time

was raised as a potential barrier, the independent nature of the experiences – in combination with their interests in the topics (Bathgate *et al.* 2014) – provided additional motivation for these participants, potentially as the responsibility required of them was a novel dimension. The notion of independence relates to the idea of choice, which I explore in the next section.

6.2 The complex role of choice and how this is influenced

The role of choice within science experiences – or even in deciding to have the experience or not – is considered to positively contribute to the experience itself, especially for having control within learning experiences (Stocklmayer *et al.* 2010) as well as being linked to promoting interests in science (DeWitt and Storksdieck 2008). More specifically, having the ability to choose was perceived by Young SAGE participants to aid enjoyment, be a source of motivation, and extend an individual's own existing interests. However, where choice was not possible in an experience, this was sometimes regarded negatively but also unnecessary at times. Thus, within this section, I discuss these diverse perspectives on the role of choice, as well as the influence of supportive advisors in enabling Young SAGE participants' choices.

6.2.1 Reflections on how choices contribute: enjoyment, motivation, and pursuing own interests

Several participants raised the link between choice and **enjoyment**. Choice was beneficial in improving experiences by providing different options to select between, or by avoiding the negative situation where individuals are forced to do something. For example, Sarah positively reflected on her visit to a university laboratory:

> **Yeah, I think [choosing the experiment to do next] was a positive. Yeah, because […] it gave us the option. It's also better to do something that you're actually interested in, so if you just got assigned one that you didn't want to do then you probably wouldn't have had as much fun… (Sarah interview, 5th Sept 2017)**

The freedom to choose enabled Sarah (as well as her fellow classmates) to have a more enjoyable experience directly because they could select options that they would be more interested in exploring, and therefore had a sense of control of what they would be doing (Stocklmayer *et al.* 2010). This contribution to enjoyment of the element of control was also highlighted by Luis in discussing his science baccalaureate (see section 6.1.7). Without being able to choose, the activity would be a "…task and a struggle" (Luis interview, 17th Nov 2016): Luis' negative language indicates a sense of obligation that would make the experience more difficult to engage with and complete.

Similarly, the possibility to choose can **motivate** individuals into persisting with an activity or independently explore a new topic. In reflecting on her own science experiences, Laura suggested that her prior perceptions could negatively affect the possible benefit she would realise from her involvement:

> **I think if I was forced to go to something that I knew I wasn't going to enjoy, […] I would go but I wouldn't take as much from it and […] I go home and sometimes if I'm really interested, I'll try to find out more, but I wouldn't do that if I didn't enjoy it, cos I just wouldn't really care. (Laura interview, 18th Nov 2016)**

Therefore, for raising longer-term interest from events such as school trips (DeWitt and Storksdieck 2008), perhaps the option to choose could directly influence the initial mindsets of some young people. Offering no choice at all, could negatively impact how individuals receive the experience, and limit the potential for an interest to be sparked. This idea of an individual 'caring' about an activity was also reflected on by James in relation to science fairs (a form of science competition):

> **…[in the late primary phase] people were forced to do science fair projects: we ended up with a pile of crap from basically all the teams except for the few who were interested, so, I think there has to be some level of motivation... (James interview, 18th Nov 2016)**

The lack of choice given to the children in the science fair directly affected the standard of projects produced. James considered that those who were more interested were also more motivated to do well which resulted in comparatively

better projects. This view is supported by Bathgate *et al.* (2014) who suggest that more motivated individuals are more persistent where necessary within science experiences.

Furthermore, **existing prior interests** was an important factor for several participants. In her comparison of two school-related assignments, Jess judged her physics project as being better mainly due to the greater independence she was given:

> **So I did the use of smoke alarms in detecting and saving lives […] it was more interesting for me especially, because I got to do my own thing really, just have a bit more fun with it! (Jess interview, 25th Nov 2016)**

This specific example brings together several key benefits that Young SAGE participants identified related to choice. Jess already had an interest in the topic she chose to pursue, which then positively impacted her enjoyment, and may have improved her motivation (and persistence) to complete the task as well, particularly given the independent space she was granted to explore the project's theme.

However, freedom to choose may not always be required. Although it is suggested that informal science experiences should "…give students a measure of choice and control over their experience…" (DeWitt and Storksdieck 2008: 191), it was not the case that the Young SAGE participants regarded the idea of choice as essential for each stage of a science experience. For example, Helen seemed content with the lack of choice of the animal to study within her zoo research project:

> **[Not having the choice…] makes me focus more on the actual task rather than how cute the animal is. I think that if I'd gone for meerkats, I wouldn't have been able to focus cos they're so cute so it is quite good in a way. (Helen interview, 28th Nov 2016)**

Helen recognised that given free choice, she may not have made a sensible decision; the lack of choice here enabled her to focus on the research steps. Similarly, within Alissa's dentistry work experience, she wanted more choice and

interactivity to make her time more interesting, however she recognised that although she felt bored, she actually gained significantly from her experience:

> **[If I didn't stay] in the same place, then I might not have learnt as much, [in comparison with] just sitting and watching and like taking notes and stuff like that, like, cos like looking back on it, I did learn a lot more than I thought I did during the time… (Alissa interview, 9th Dec 2017)**

Although she had been frustrated with her relatively passive position in the room and having to listen to the dentist's explanations, being forced to make notes seemed to be of greater benefit in terms of learning about the job. So there were times where choices within science experiences were not seen as necessary by Young SAGE participants, and in fact there were benefits to not having a choice. However, these particular examples were related to experiences where there had been an earlier choice to get involved. This factor may have allowed participants to more easily accept aspects of these experiences where different options were not available. Furthermore, there were also occasions where taking away the choice would not have changed anything for some participants, since they would have wanted the experience anyway due to their existing interests, as Dean suggested through reflecting on his space-school experience:

> **I don't think anything really would have changed how I would have enjoyed it or anything […] it was just completely geared towards things that I'm interested in.**
>
> **[…]**
>
> **I don't think if I'd been made to do it, it would have made a difference, because I would have been like "Yes!" (Dean interview, 7th July 2017)**

In contrast, some participants suggested that a lack of choice for young people can have a negative effect on an individuals' perception. Jess compared a potential complete lack of choice to being forced to eat potato when she was young, which put her off potato for many years afterwards. James expanded on his science fair reflection that only the interested and committed teams produced good results (see earlier in this section) by suggesting:

> **I don't think it's possible to demand extracurricular work of a group of students that'll just lead to people getting frustrated and annoyed… [and…] help to decrease their opinion of the sciences… (James interview, 18th Nov 2016)**

Therefore, on the one hand, it seems that for young people who are already interested in the topic of an experience, providing choices can improve their enjoyment and motivation, but it might not be necessary. On the other hand, removing choices and forcing young people to undertake a task or be otherwise involved could potentially be discouraging in the longer term for those who are not already interested. This suggests that relating experiences to specific interests young people already have (Stocklmayer *et al.* 2010) and providing some options to select between could be advantageous in engaging young people with science. This implies that important contributions are made by informal science activity providers (e.g. science festivals and museums) as it is arguably easier for choice to be present in these contexts in comparison with school-based science (Stocklmayer *et al.* 2010). Furthermore, the topic itself may not be traditionally science-based: for example, using a music-based approach – such as that seen in the Science Ceilidh[37] project – may be a hook for science engagement that appeals more to those interested in music.

6.2.2 Supporting the choices of young people: parents, teachers and other young people

Young SAGE participants provided many examples of how the influence of others played an important guiding or enabling role. Most commonly, the support of parents (Hall and Schaverien 2001) and teachers (DeWitt and Storksdieck 2008) seemed to be important, but interestingly the influence of other young people was also apparent.

[37] https://www.scienceceilidh.com/

6.2.2.1 Influence of parents

The background of the Young SAGE participants' parents was a potential contributing factor in their support and influence on participants and their science-related interests. James succinctly stated this in the following way:

> **…my Dad has a PhD in electrical engineering and my Mom has a degree in medicine so I've been pretty influenced by them most of my life. (James interview, 18th Nov 2016)**

James' substantial interest in electrical engineering – he had been doing projects at home since primary school age and went on to study the subject at University after leaving school – could arguably have been influenced by his father. However, supporting an interest in the sciences does not always have to relate to the parents' own science interests; the support of parents itself can be constructive in how young people explore the world around them and decide on their future plans. Jess in particular reflected that her parents had been important for her decisions regarding future options whatever they might have been:

> **…it's been great that my parents have been so supportive in trying my own thing and they have been like "Go and try that and try this and find out what you want to do", and it really helps me find out what I do enjoy and it happens to be sciences you know, it could have easily, easily [been] me loving English and my parents would have been "Yeah go to different things". And since that they've known that I've been enjoying sciences I've been thinking about different things I want to do, they've been really supportive and found me things to do with that since then they're really interested in… (Jess interview, 25th Nov 2016)**

As well as the supportive influence of her parents, Jess also suggested that if parents are not interested in sciences they could be less likely to foster an interest in science within their children. Jess' assertion and James' parental backgrounds relate to the concept of science capital (Archer *et al.* 2013). Based on Bourdieu's (1986) explication of economic / cultural / social capital, the foundation of science capital suggests that close family members working within science disciplines or having active interests in science increases the possibility for young people to view

science positively and aspire to science-related careers (Archer *et al.* 2013, DeWitt and Archer 2017, Archer *et al.* 2018). However, this view of science capital does not mean that certain levels of support and guidance guarantees a future science career, since an individual will have a variety of other influences on their choices too. Furthermore, in Jess' particular case, it was not so much the *science* capital of her parents that was important, but their *cultural* capital (Bourdieu 1986) and how they fostered this in Jess through enabling access to different experiences and resources (e.g. books, events, TV programmes – see section 6.1.8).

During the third Young SAGE gathering, Jess raised the notion of parental support again, which was swiftly discussed by the group and illustrates its importance to them:

> **Lisa: So my parents were encouraging enough and stuff, but they never did anything sciencey, my dad was all languages and my mum did biology for a bit but then she did took [unclear] stuff.**
>
> **Alissa: My Dad is interested in science, but he didn't do anything about it, like he would take me to science museums or whatever…**
>
> **Several: Yeah.**
>
> **Alissa: …in Florida, and took me to NASA, that was it, it was an experience for a day. It wasn't encouraging all the way through like, try this, go there, do this you know…**
>
> **Several: Yeah.**
>
> **Megan: My mum loved to take me to the [local] Science Festival (Several: Yeah!) when I was younger… (3rd Young SAGE gathering, 19th Mar 2017)**

Here, Lisa suggested that her parents had little ongoing science links, but they – in a similar way to Jess' parents – were still supportive of her science-related choices. Again, the broader notion of cultural capital appears to be important here (Bourdieu 1986). Alissa and Megan, who both had at least one parent who was explicitly interested in science, shared further examples of how they were taken to science festivals or museums in the past. During this Young SAGE gathering, Alissa

downplayed the role the visits with her father had played in her developing science interests, but her reflection in an earlier interview suggested that her father's enthusiasm in these one-off visits actually had a strong positive influence on her own science attitudes:

> **…my dad, he's a massive geek, he just loves everything: space, sci-fi, all that, so his enthusiasm really rubbed off on me, like he really loved the trip, cos it was just me and him and it was our little day trip away from the family in Florida… (Alissa interview, 9th Dec 2016)**

So although Alissa's father did not constantly encourage her to undertake different experiences in the same way that Jess' parents did, the experiences that Alissa shared with her father appeared to have had a strong impact on her since '…his enthusiasm really rubbed off on me…'

The nature of parental support does not have to be where parents explicitly lead the engagement, instead they can share an interest that their child has cultivated themselves, as Mark illustrated in his reflection on his science-video engagement:

> **…my brother likes [VSauce] as well. It's mainly me, but maybe I put it on in the background when I'm doing other things and he's there, and he watches with me and stuff and then my parents, if I find a good [video], I'll share it with my family and stuff and they enjoy it as well. (Mark interview, 11th Jan 2017)**

Mark's initial motivation to engage stemmed from his own interests and his assessment of the quality of the videos themselves. Additionally, his enthusiasm was enhanced through sharing the best videos with his family for them to also enjoy. As suggested through research on museums (Mujtaba *et al.* 2018) and family-based science projects (Hall and Schaverien 2001), there are positives to socially based engagement both in terms of learning and fostering interests. Mark's example suggests how a positive reinforcement loop can form: Mark enjoys the content and shares the experience with others in his family, who also appear to enjoy it which endorses and enhances Mark's initial positive impression. Furthermore, this cycle enhances the science (and cultural) capital of the family

overall, illustrating how young people can be a positive influencer rather than solely being a passive entity to be influenced (cf. Archer *et al.* 2018).

How parental influences occurred was unique to the individuals involved: some parents offered consistent support and encouragement, whereas others made suggestions or got involved infrequently. Participants did not perceive the same level of inputs from their respective parents. Thus, there seemed to be no single way that the Young SAGE participants had been encouraged and supported to pursue their science interests: the influences were arguably embedded within the diverse parent-child relationships that they had developed over time, which were all different to each other. The fostering of capital – whether linked to science (Archer *et al.* 2013) or culture and/or social fields more broadly (Bourdieu 1986) – was an important aspect for many Young SAGE participants.

6.2.2.2 Influence of teachers

At a basic level, teachers not only provide formal science lessons, they also share awareness of different science experiences. Amongst the Young SAGE participants, the Talent 2030[38] competition, the science baccalaureate, accessing public lectures, were just some examples they discovered through their teachers. However, more importantly, teachers are themselves important influences on the young people they teach:

> **My biology teacher is really enthusiastic […] she's always up for helping us in our application for it and just really like excited and wanting to hear about it so yeah, she's really helpful. (Helen interview, 28th Nov 2016)**

In going beyond usual teaching, Helen's teacher could have been a pivotal contributor to Helen's involvement in other experiences, such as the supported research projects, and her attendance of medicine-related public talks. Mark's physics teacher, who planned to set up an astronomy club at the school, was a

[38] http://talent2030.org/

further example of how teachers share their passions for various topics and offer further experiences that can feed young people's interests. The thirst that teachers have for their subjects positively influence the interests of their pupils, as Jess revealed:

> **[…my physics teacher is…] a great teacher and he does make the subject more exciting, so […I think having…] a teacher that can make [the subject] genuinely interesting, I think that makes a big big difference. (Jess interview, 25th Nov 2016)**

As highlighted within a summary by Stocklmayer *et al.* (2010) of a 2009 Department for Business, Innovation and Skills report, unfortunately there has been much negativity surrounding the teaching of science (particularly around primary teachers lacking sufficient understanding of science content – see section 6.3.2.1)[39]. This is a vital issue to address, especially as the quality of the teaching and teacher in engaging young people with their subject can play an important role in encouraging their pupils to select the subject for further study, which Jess (supported by Lisa) suggested:

> **Jess: …like where do [young people] get their influences from, whether it's sort of love for the subject or if it's like your teacher…**
>
> **Megan [quietly]: teachers, friends…**
>
> **Jess: …and whether that, I mean I know that's why I took physics.**
>
> **Lisa: Yeah, same.**
>
> **Jess: But then I ended up really enjoying it.**
>
> **Helen: Yeah. But then somebody who is a teacher may make you like the subject less. (3rd Young SAGE gathering, 19th Mar 2017)**

So for Jess, the quality of her teacher was a highly influential aspect in her choice to take the subject further, and it appeared that the quality of the teaching came first: Jess only started enjoying the subject itself at a later stage. Within this exchange,

[39] In Scotland, the RAiSE project is seeking to address this very issue currently: https://www.thewoodfoundation.org.uk/developing-young-people-in-scotland/raise/

Helen also highlighted the opposite possibility: that a teacher could discourage a young person from studying a particular subject (like the "Lost Potentials" in Aschbacher *et al.* 2010). For Young SAGE participants, they regarded the influence of teachers as both a source of positivity and negativity, which relates to personal connections within science experiences being an important dimension (see section 6.1.5). Therefore, for public engagement, how the engager is perceived – particularly in terms of their enthusiasm – can be a significant influence on how those they engage respond to the topic and content later on.

6.2.2.3 Influence of others

Although the influences of parents and teachers were undoubtedly the more frequent examples mentioned by Young SAGE participants, it should also be recognised that other family members have a role to play, as Dean revealed with his uncle enabling a visit to CERN and a visit to a laser-manufacturing company. Furthermore, young people themselves are not passive members of society: they can influence others around them, as Rory described with his Go4SET competition involvement and his support of early secondary-school pupils with their designs (and reflected also by Megan's quiet mention of "friends" being a possible influencer in the previous excerpt). In addition, when Luis was deciding whether or not to undertake a science baccalaureate project, the main influence was not the invitation or information from teaching staff, but rather the experience of another pupil who was completing his own science baccalaureate:

> **…he spoke to us about it when we were just in class […] and we were just speaking to him and asking about it. So he gave us more information, I think that was probably one of the biggest sort of factors that got us interested in it, him telling us what it was about. (Luis interview, 17th Nov 2016)**

Therefore, it is not always the case that an adult is in the position to positively influence young people, there are circumstances where young people can helpfully support and encourage each other too, as well as other family members (as in Mark's YouTube experiences discussed previously).

6.2.3 Discussion

This section has shown how involving choice within science experiences can play distinct roles in how science experiences are perceived by participants (DeWitt and Storksdieck 2008). On the one hand, the possibility to choose can enhance a young person's enjoyment of an experience as well as their motivation to persist with experiences of a more-involved nature (e.g. competitions, independent projects) (Bathgate *et al.* 2014). On the other hand, an absence of choice could de-motivate participants and at an extreme level – as Laura reflected – may affect an individual's focus on the exercise, consequently reducing any potential benefit, particularly enjoyment, resulting from their involvement.

However, this section has also illustrated how the option to choose is not always necessary. Being given a focus animal for Helen's research project, the absence of interactivity in Alissa's work experience, and Dean's linear space-school programme, gave insights into how the absence of choice can have a neutral impact or arguably improve experiences. However, participants within these examples had made choices to become involved in these experiences at an earlier stage. Thus, the possibility of choice at some point prior to and/or during science experiences is likely to be beneficial in terms of the overall impact on an individual, aligning with conclusions made by Stocklmayer *et al.* (2010).

In looking at how the choices of young people are made, Young SAGE participants shared many examples of how they have been influenced. Echoing the principles of science capital (Archer *et al.* 2013, DeWitt and Archer 2017, Archer *et al.* 2018), my analysis supports the idea that parents and teachers are important sources of influence on young people, which has started to be reflected in policymaker strategies around science engagement (e.g. Scottish Government 2017). However, thinking of science capital in this way raises two specific issues. Firstly, considering capital on its own does not guarantee certain outcomes for the individual, and relying solely on this concept obscures their agential potential. Secondly, Bourdieu's (1986) explication of capital for educational settings is bound with an age-

segregated view of society (Vanderbeck 2007), and positions children and young people as passive entities waiting for adult (mainly parental) influencers to act upon them. This is an incomplete view of Young SAGE participants own experiences which are infused by their relationships: beyond interactions with adults, they were also influenced by other young people, as well as being influencers of adults themselves, in addition to having the independent capacity to choose.

6.3 Young people's perspectives on the purposes of public engagement with science

Building on the important dimensions of science experiences and the role of choice that I have attended to so far, I now explore what participants prioritise for their involvements in science experiences, which in my discussions with participants can be drawn together to be: sparking or extending an interest; learning new ideas; and inspiring possibilities for post-school options.

6.3.1 To spark or extend an interest in a topic

The possibility of a single experience to ignite a passion for a particular science or scientific topic was an assertion made by several participants. Alissa's first visit to the local science festival appeared to be a catalytic moment, as she claimed that her love of science:

> **…started in P7, we did this trip to the [city] Science Festival and like literally I was fascinated by everything, I wanted to do everything, see everything, and then when I got into like S3 I was picking my subjects, I was like I want to do as many sciences as I can.**
>
> **[…]**
>
> **…we were all so interested [in the festival activities] and most of the people that were in my class in P7 now do Higher sciences… (Alissa's interview, 9th Dec 2016)**

The excitement developed by this science festival experience remained clear in Alissa's recollection of the visit: the joy and wonder she felt for the sciences in later

years were sown by science festival, which she claimed had a long-term impact on her own interest in science, as well as her classmates. Although there are calls for school-based science teaching to make more of the complementary opportunities provided by informal settings (DeWitt and Storksdieck 2008, Stocklmayer *et al.* 2010), like science festivals, Alissa's account demonstrates how young people can already make these links themselves. The suggestion that science festival experiences at younger ages can inspire further engagement was supported by Jess' assessment of the local science festival's influence:

> **"[…if] you can get kids interacted at a young age, you're more likely to sort of see it flourish at later ages of schooling." (Jess interview, 25th Nov 2016)**

The perspectives of Alissa and Jess counter arguments that one-off experiences result only in short-term influences on people's interests: I have heard colleagues raise the issue of 'parachuting', i.e. running a single activity with no follow-up for those engaged. This view is in accord with criticisms of one-off interactions being tokenistic, and therefore not leading to real change or impact on the topic at the centre of a participatory process (Stafford *et al.* 2003, Hill *et al.* 2004). Additionally, the argument around parachuting rests on the assertion that assessing the impact of short-term experiences is difficult (DeWitt and Storksdieck 2008, Mujtaba *et al.* 2018), despite positive claims regarding the affective (interest / attitude) as well as cognitive (knowledge) effects of informal science experiences (Stocklmayer *et al.* 2010). However, my research challenges this conceptualisation of 'parachuting', which gives young people a passive status and ignores the possibility of those engaged being inspired to seek out further information and experiences for themselves. Instead of a holistic view of the range of experiences an individual has, this parachuting notion shifts the focus to the specific experience and the impact this has had on those engaged within a limited time-frame. However, it is unrealistic to expect a dramatic shift of attitude or interest within every single science festival attendee, but there is the potential for impacts to happen when further experiences are combined: "The heat to spark the flame can come from any encounter with

science – in the classroom, from a museum educator, at a science festival" (Archer *et al.* 2018: 9).

This spark does not have to relate to interactive activities, nor be at a very young age. In their separate introductory interviews, both Emma and Mark independently raised their ambitions for further space-related experiences after visiting the local observatory, with Emma later participating in a summer space school during the course of the Young SAGE project. Dean attended the same space school, which built on his enthusiasm for physics in general, and in addition sparked his interest in sub-disciplines of which he was previously unaware. Also relatively recently, Jess' inspiration for architecture was instigated by a TV programme, an interest she then followed up through reading books and attending public talks which enabled her to discover more. The interlinking of Jess' experiences supports the assertion that young people learning from science on TV can be motivated to seek related experiences (Dhingra 2006). The perspectives of these Young SAGE participants suggests that the specific topic is the most important element of a science experience (rather than a subject, e.g. biology), which supports the argument of Bathgate *et al.* (2014). Their ongoing interests were sparked by a single experience, but had been enhanced by several combining together over time. This suggests that the topics were the key motivators (see also 6.1.1), rather than the format: e.g. Jess' interest in architecture was the foundation for having related experiences, not a preference for a particular mode of engagement.

6.3.2 A focus on learning new information

Science experiences related to learning were a common theme in perspectives shared by participants. Both in terms of past experiences they had and future experiences they wanted, the desire to learn was central to many examples raised.

6.3.2.1 The importance of experiences from a young age

There was a shared view amongst Young SAGE participants that learning about scientific topics from a young age was particularly important – a point reinforced by Jess' comment regarding engaging young people through science festivals to spark an interest (section 6.3.1) as well as the initial aim of participants to engage primary school-aged pupils with the Young SAGE event. The importance of learning from a young age was the focus of a conversation critiquing primary school science teaching:

> **Alissa: The only thing I remember about science from primary school is having to make papier-mâché planets…**
>
> **Megan: What the hell is that about?**
>
> **Helen: Yeah, that's cool! [Overlapping comments]**
>
> **Megan: That's not very sciencey.**
>
> **Emma: I don't think we even learnt about the planets, it was just "oh there are seven planets" and then make a papier-mâché one!**
>
> **Alissa: We got a picture, and then they said "Make one". I was like… [pulls face]**
>
> **Helen: That's fun though. (3rd Young SAGE gathering, 19th Mar 2017)**

Here, Emma and Megan were more negative about the task of producing replicas of planets using papier-mâché in comparison with Helen: for the former two participants, the task had little scientific merit as they did not learn much about the planets. Helen did not argue against this perspective, but still remained positive about the experience: the enjoyment she had doing the task outweighed any negativity concerning the lack of scientific knowledge. Thinking back to the dimensions of science experiences, the perceived lack of authenticity was the main issue for Emma and Megan, whereas the novelty of the task enhanced Helen's positive reflection. During my introductory conversation with Sarah she also suggested that science in primary schools was restricted (see Leonardi *et al.* 2017):

…in primary school you don't really learn about science per se […] I suppose they teach biology, like the food chain or the food cycle. They don't teach you per se about chemistry or physics. I only remember learning about friction… (Sarah interview, 5th Sept 2017)

Although Sarah was negative in her assessment of science teaching at her primary school in that it only focused on biology-related concepts if any, she still offered a few example topics as did participants in the third gathering after a little prompting of each other:

Alissa: I can't remember doing much science…

Emma: In primary school, I remember one thing about volcanoes and that's it.

Alissa: Yeah, it was like volcanoes and like, this a human body, some bones…

Emma: Yeah, like the digestive system. (3rd Young SAGE gathering, 19th Mar 2017)

The examples that participants raised could be the actual extent of the science-related topics that were taught during their times in primary schools. Alternatively, there may have been other topics, but the teachers did not refer to them as 'science' and so the Young SAGE participants may not have appreciated the link. This lack of explicit science is reflected by research into primary science teaching which reveals that schools in Scotland deliver weekly science lessons less frequently in comparison with other UK nations, and for the schools that teach science weekly, it is seldom delivered as a standalone subject (12-17% of the time depending on the year group, Leonardi *et al.* 2017). Therefore, although Sarah was able to relate her topics to specific sciences, potentially there could be more topics with science links that were not made clear at the time the Young SAGE participants were in primary school. A further issue is one of memory recall (Seidman 2006): the above excerpt shows how Alissa and Emma both prompted each other to remember further science-related topics.

Despite any potential recall issues, the idea of learning science from a young age – alongside other topics – was important for Young SAGE participants:

> **Stuart: …primary school, what you're learning there, seems to be quite critically important…**
>
> **Several participants: Yeah.**
>
> **Alissa: It kind of stays with you.**
>
> **Stuart: […] so why is that a greater thing than anything else that you do whilst you're six, seven, eight, nine?**
>
> **Jess: Whilst you're young your imagination also drives you… [Couple of participants: Yes.] ...so if you've been talking about science or something and then you sort of imagining going out into space… [Lisa: Yeah.] …and doing all these amazing things and that's where sort of…. [Overlapping comments] …interest in these areas grows.**
>
> **Megan: Take us for example, try teaching a language to a young child and they'll get it, you know… [Several participants: Yeah.] …but teach it to someone who's older, and they will struggle…**
>
> **Alissa: They don't understand.**
>
> **Lisa: It's harder.**
>
> **Megan: …like for us now, like there's people been learning…**
>
> **Alissa: Like little kids might be like sponges and like…**
>
> **Helen: But they teach language in nursery now.**
>
> **Alissa: …and if you teach them something…**
>
> **Jess: They'll remember it.**
>
> **Alissa: …at that age they'll remember it, it will stay with them, it'll grow in their minds if you teach them. (Excerpt from 3rd Young SAGE gathering, 19th Mar 2017)**

This passionate discussion amongst the participants raises three distinct ideas. Firstly, there was the emphasis on fostering an interest from an early age, as younger people are potentially more imaginative and can therefore be inspired. Secondly, the language-learning capabilities of young children was brought in as a

comparative example, based on the common belief – supported by Hartshorne *et al.* (2018) – that learning foreign languages is easier for young people: the earlier that ideas are introduced, the greater potential there is for concepts to be retained. Thirdly, the general enthusiasm and agreement for the idea that science experiences should be available to young children was particularly obvious during our discussions – especially in this excerpt: several participants made active contributions and were supported through verbal confirmations from others. Learning about scientific topics from a young age was considered as an important foundation for encouraging interest in the sciences later on.

6.3.2.2 Science in the real-world: providing context for learning

In addition to the importance of learning about sciences from a young age, the relevance of the subject matter at the heart of science engagement needs to be considered. This supports Bennett and Hogarth (2009), who – based on their survey-based approach – suggest that linking science concepts to real-life contexts is important for young people. Megan's view of the progression of school-based science reveals her frustration with the lack of contextualising:

> **I find that in your first years of high school and the last years of primary school, science is advertised as this really fun subject: you get to do all these amazing experiments, you get to learn all about the universe, you get to learn how the planet works. And then, as you get older and start doing the required work, it gets a bit boring, it's more about theory, about doing equations and stuff and you don't really get to learn much about how the world works. You get told what things are, you're never really told what they apply to. (Megan interview, 16th Nov 2016)**

The impact of Megan's initial school-based science experiences was that it was fun and interactive and you got to learn about things around you, which links to notions of novelty and entertainment explored earlier in this chapter. Later, the "required work" became more abstract and the relevance of the scientific concepts to the real world was obscured. Supporting Jess' independent reflections on the benefits of public exhibitions, Megan suggested that linking learning experiences to real-life

situations aided the motivation to engage. The notion of relating concepts to real-life situations to learning was further supported by Alissa within her upper high school chemistry course:

> **I really loved unit two where we explored more about esters and chemistry of cooking – going back to cooking, how much I loved looking at the start [of the interview]! – it was more about chemistry in our actual lives instead of "If you do this experiment, you will get this result, and then you will have to do this in order to like graph it all", instead of actual real-life situations like this is actually what you're putting into your body, it's what, it's surrounding you, it's like the environment you're living in… (Alissa interview, 9th Dec 2016)**

Alissa had a definite interest in cooking – it was one of the three things she declared were her favourite things to do at the beginning of our conversation – which increased her enthusiasm for this part of the chemistry course. In her critique of science at school, Alissa made a distinction between the relative mundanity of the mechanics of experimental data analysis and the actual content of a specific topic that linked concepts to the wider world. This view of better linking to young people's own interests and relevance to science in today's world has been supported by previous research, as Stocklmayer *et al.* (2010: 4) address in their review article: "There have been calls for science education to be more relevant to young people's lives, to more faithfully reflect the conduct of science itself and to be taught through inquiry." These calls are further supported through more recent studies (e.g. Archer *et al.* 2018). By focusing so much on the mechanics of equations, as Megan highlighted, school-based experiences in secondary school can become relatively abstract: the lack of context reducing the learning impact and the relevance of the topics.

Within reflections on a Polymerase Chain Reaction (PCR) workshop – an example of how experiences developed outside the formal school environment can support the delivery of key parts of the education curriculum (Stocklmayer *et al.* 2010) – there were further suggestions about the importance of real-life links:

> **[The PCR workshop] was to show us that what we're learning in class is actually happening in real-life, like the knowledge that we're getting now, we could use in the future if we went into like genetics, so it was to show us that, it's not just for an exam: if you keep the knowledge and learn it, that you can use it. (Alissa interview, 9th Dec 2017)**

Although the workshop had clear links to the curriculum and what young people needed to learn in order to pass their exams, Alissa perceived an additional message regarding the use of PCR techniques beyond the curriculum context as the technique is used by laboratory-based researchers. The real-life authenticity of the experience further enhanced the enjoyment of the activity:

> **[The PCR workshop] was really interesting and we all really enjoyed it, but that's the only time we've ever done something like that. I mean I think that if we'd had more experiences like that where we could actually go somewhere where they had the equipment needed and we could do more experiences I think it would be good. (Laura interview, 18th Nov 2017)**

Laura's review reflected positivity on behalf of everyone in her class, due to the unique nature of the experience as it was 'the only time we've ever done something like that', which resonates with the novelty factor (Boeve-de Pauw *et al.* 2018) highlighted by other Young SAGE participants regarding other science experiences (e.g. the public exhibitions). The implication appeared to be that the use of authentic equipment used within contemporary laboratories enhanced the impact of the workshop (just as engaging with authentic fossils is perceived as contributing to motivation of those engaged in Mujtaba *et al.* 2018). The advantage of relating experiences to the real-world was also important for James' efforts in the CanSat engineering competition, where teams of upper secondary school pupils and university students used their prior knowledge to design and build small satellites, and used genuine systems in achieve their goals. Therefore, particularly for those learning beyond an introductory level, establishing the link between science and the real-world appears to be a factor of increasing importance.

6.3.2.3 Motivation supplied by personal experience

The drive to learn can be instigated by a range of personal life-experiences; the motivation is not only driven by a particular learning interest. Helen took her nascent interest in medicine further by attending a series of lectures aimed to support post-school medical ambitions as well as other medicine-related talks. One example was an inaugural lecture at a university for which she had registered for its mailing list. This lecture was one of several that she consequently attended:

> **…the first one was about strokes which I personally was quite interested [in] because a family friend of ours had a stroke quite recently, so it was quite interesting seeing the different types you can get and how they actually affect you and how they are caused… (Helen interview, 28th Nov 2016)**

Not only did the general topic of medicine and its potential as a future career option motivate Helen, but the specific focus on strokes provided additional interest due to the recent event of someone she already knew. These factors of future careers and learning more about a condition due to personal reasons, match those identified by Fogg-Rogers *et al.* (2015) in their exploration of motivations of attendees to a health-related science festival in New Zealand.

6.3.3 Sparking ideas for future options

The notion of exploring ideas for potential future careers appeared particularly important for Young SAGE participants, and was likely of interest as they were all in the final years of secondary school. Therefore, the increasing interests in real-life links to science may have been driven by participants' considerations for their own futures. Within Scotland, the start of the decision-making mechanism for future careers is arguably made with the subject-choice process, and there were revealing reflections on this process within a Young SAGE discussion:

> **Megan: […in S2…] some people find that too early to figure out what they want to do… [Several participants: Yeah.] …when they're older and they start panicking. I mean for me I was quite lucky, I already knew what I wanted to do…**

Lisa: I panicked.

Megan: …but a lot of people were like: "What do I choose?" You know? "What do I want to do when I'm older, when I have [not] chosen yet?"

Jess: I picked subjects and then decided that that's not what wanted to do, so I changed.

Megan: Some choose without having a passion for the subjects they chose.

Lisa: I just thought I could quite like science (3rd Young SAGE gathering, 19th Mar 2017)

These reflections suggest that many early secondary school pupils are underprepared for the subject choice process as they do not have clear post-school ambitions, which negatively impinges on their ability to choose subjects with a clear target. Megan removed herself from this general position by stating that she was 'lucky' since she knew what her post-school ambitions were, however Jess was uncertain and Lisa 'panicked'. Therefore, within science engagement experiences, support related to young people's subject choices through providing relevant information about topics and how they relate to school-based subjects and career options later in life could be helpful. One idea from Sarah was to have scientists visit schools and provide overviews of what they actually do on a daily basis, the importance of which could be enhanced due to engaging an authentic scientist (Stocklmayer *et al.* 2010) – just like Megan's science festival experience in section 6.1.4. Additionally, within our discussions following the Young SAGE event in March 2018, there was qualified support for the idea of linking interactive activities to careers:

Dean: …the forensic one could have had more of a career link I think [Sarah agrees]. And some of them I don't think really needed it. […] Some of them it makes sense, and others it's more get engaged with the subject and hopefully from that interest, you yourself will find out [Sarah agrees] about a career.

[…]

Dean: [The event attendees] are so young and I was asking some of them if they have any idea of what subjects they want to do, and the furthest they had thought was third year…

[…]

Dean: So maybe making a leap to a career straightaway isn't right for all of them [Emma agrees] …but possibly getting more interest in that subject is maybe more relevant to that age?

Stuart: So it's the interest in the subject is the primary thing [Dean agrees], but if there are links to a career that doesn't do any harm?

[Strong agreement from all]

Dean: For the ones that are obvious, it makes sense to have them in, but then it would be pointless for the slime [activity]: this is the subject that it's to do with, and here are jobs in that subject that are completely unrelated to slime! [Group laughter] (Post-Young SAGE event discussion, 20th Mar 2018)

Two ideas were supported in Dean's summary (with verbal support from Emma and Sarah, the other participants present). Firstly, at an introductory stage, the priority is on engagement around initial concepts to perhaps spark an interest to be taken up further. The focus on interest is necessary since many early secondary school pupils will not be thinking of post-school ambitions: just as the Young SAGE participants revealed with respect to their own experiences. Secondly, exposure to careers ideas as part of science experiences would be a positive contribution – as Bennett and Hogarth (2009) conclude for school-based experiences – as long as the link between the activity and the career is clear and appropriate. Dean suggested that the forensics stall at the Young SAGE event may have done this, but the slime-based activity had less opportunity to do likewise due to the nature of the activity. Within the Young SAGE event, Sarah endorsed the astronomy-activity's approach:

Sarah: …I feel that the astronomy corner was pretty good… [Dean / Emma: Yeah.] …they were really well-informed and they had leaflets about careers…

Dean: That was much more career…

Sarah: …based…

Emma: But I don't think that's necessarily a bad thing.

[Dean / Sarah agree]

Sarah: That's what I'm saying, it probably made an influence: maybe it has attracted kids to pursue a career in astronomy or space. Even the leaflet itself showed all types of jobs you can do like helping with space even if it isn't working on a space station. (Post-Young SAGE event discussion, 20th Mar 2018)

The additional benefit was not solely focusing on the unique careers that only a few people will be able to achieve (like being an astronaut): the stall provider also included information about other careers related to space science, thereby making the suggestions more inclusive. By providing this information during the event, Sarah thought that some of the early secondary school pupils may have been inspired to consider these related careers for their post-school ambitions. This view highlights the variability in who is engaged: for some, the priority will be learning about the science itself, whilst for others, learning is important, but the possibility to link interests to potential future career options will improve the experience.

Whilst some experiences might spark or confirm an interest in a particular topic for future careers, others can elicit the opposite reaction, as Alissa revealed in her reflection on the PCR workshop:

It just kind of made me realise that I don't like that sort of biology!

[…]

I enjoyed being able to take part in the experiment and being able to do it myself, but it was very time-consuming […] and as much as I enjoyed that day, I wouldn't want to do it for the rest of my life… (Alissa interview, 9th Dec 2016)

Although Alissa enjoyed the experience, this feeling was distinct from her wanting to do this type of work within a future career. This conclusion was matched by Sarah in response to her zoo research experience. Enjoyment is one dimension of an experience, and is often referred to as a prominent positive of informal science experiences such as exhibition visits and science festivals (DeWitt and Storksdieck

2008, Wilkinson *et al.* 2012, Jensen and Buckley 2014). However – as this reflection from Alissa highlights – enjoyment does not always result in a participant wanting to do more of that experience: they are distinct outcomes. As DeWitt and Storksdieck (2008: 193) mention in a footnote: "…realizing what one does not want to do is as important as the opposite." This astute observation does cause a problem for those delivering the specific exercise: they are likely to evaluate that the experience has been a failure, since they have not sparked an interest in the person they have engaged. However, the lack of ongoing interest following a science experience should not automatically be considered negatively: the experience has still assisted the individual with their deliberations over future career options, which is a positive step from their perspective.

6.4 Bringing together the key learning points for public engagement practitioners

Alongside the final Young SAGE gatherings, I started to reflect on what would be the main learning outputs which would be beneficial for other public engagement practitioners and other adults engaging young people. These reflections led to draft points that participants and I debated and refined during the 20th Young SAGE gathering, and were then the basis for further adjustment by email afterwards.

With the assistance of a graphic designer at the university, these points have been converted into the leaflet "Engaging young people with science: Learning from the Young SAGE project" (Figure 9 and Figure 10 on the following pages). This advice is predominantly focused on interactive activities, and summarises much of the analysis presented in this chapter so far, especially around: authentic experiences, personal connections, combining experiences, the role of choice, sparking interests, and considering future options. Additionally, a further advisory point was suggested by Jess and endorsed by others in our email-based discussions in October 2019: having a specific age-range was necessary to ensure that the experience was appropriate to those being engaged.

Figure 9: Front and back covers of Young SAGE leaflet

For eighteen months, a group of young people formed **Young SAGE** (Science Advisory Group for Engagement): a participative project exploring what young people prioritise within their experiences of science.

Below are some of our key learning points, which may be useful to those engaging young people with science, including: university staff and students, science festival organisers, teachers and parents.

General points for engagement

- **Young people are not passive individuals waiting for things to happen to them.** They look for opportunities that appeal to their current interests or support their future study and career plans.
- **There is not one single science experience that appeals more than any other.** Preferences relate to opportunities and personal interests at the time. Hands-on activities, public talks, exhibitions, competitions, citizen science initiatives, residential experiences, themed curriculum-related workshops, and work experience, were among the previous experiences that the Young SAGE participants have had and enjoyed.
- **Key adults in young people's lives** (e.g. parents, other relatives, teachers) **can be important supporters.** They can directly provide access to specific science experiences, or they can be helpful routes through which to get information about particular opportunities to young people.
- **Sparking an interest through even a single experience at a young age is possible.** Discussions with university staff, visits to exhibitions and science festivals, particular topics in primary school science, and others, are potentially remembered for many years and can become the basis for later interests in the sciences.
- **When designing a science experience for young people, have a specific age-range in mind and tailor the experience to them.** If you don't, you might lose the focus and enthusiasm of those you are trying to engage. However, if accompanying adults are present, be prepared for them to get involved too.

Designing interactive experiences

- For those designing drop-in activities to engage young people, as well as those teaching science – particularly at primary school level – interactivity is key. Getting young people involved will heighten the experience and be more engaging. However, still having a mix of listening and doing could be beneficial.
- In addition, it can be useful to provide choice to young people in order to make the experience more informal and relaxed. For example, a variety of activities should be available so that young people can make an active choice about what they would like to do. Also…
- …consider having activities that can be operated by a young person independently – at least at first. Particularly during festival-style events, it can be intimidating for some to have to approach an adult and start a discussion. Having standalone activities can aid in the engagement of young people who are naturally shy, by making the experience less intense. They can decide on the level of interaction they want.
- Hands-on activities can act as a springboard to a discussion about topics that may (or may not) be related to the science involved. Therefore, be prepared to discuss pretty much anything and not just things that you think are directly related to your activity.
- You, as the presenter of the activity/activities, remain an important element of the science experience – particularly if you are a science researcher or student. Develop a way of talking young people through activities and be prepared to ask questions to the people you are engaging, as well as to answer the questions you are asked! Being flexible in your approach is important: you could be asked about science research in general.
- If there is the opportunity to link a hands-on activity to a particular career, or range of careers, then make these links obvious (e.g. either verbally or through a graphic/poster). However, don't make any giant leaps between the activity and a career just for the sake of it; this won't be convincing.
- And going back to our very first point – young people are not passive individuals – try to provide information about further science experiences that follow-on from your activity, so there are some starting points on how to find out more. Examples could be specific exhibitions, public talks, online videos, festival events, and science clubs. Some young people you engage with might have their own follow-on examples, so add these to your options over time.

Figure 10: Inside pages of Young SAGE leaflet

6.5 Conflicting perspectives on participative public engagement with science

As shown in this chapter so far, the main purposes of science experiences explored in the Young SAGE group appeared to position young people as wanting more information, i.e. to be a learner in some form. This position was reflected within participants' own science experiences and their immediate personal ambitions, as well as the Young SAGE project's focus to develop an event for early secondary school pupils. Although Mark had previously participated in a citizen science initiative, most other science experiences participants had had were concerned with forms of learning or were competitive by nature. These predominant interests may be informed by the special status of science (Yearley 2005c), and the resultant boundary-work that has served to privilege the influence of science in contemporary society (Gieryn 1983). Participants may not have perceived themselves as being contributors to the development of scientific knowledge, and thus there was little existing interest in the participative mode of public engagement.

To explore this potential disinterest, I introduced to participants the notion of citizens' juries: a process in which people who have expertise related to a central issue present information and their perspectives to a jury of individuals who do not have expertise related to the problem at hand (see Evans and Plows 2007, Lezaun and Soneryd 2007). Based on the evidence presented by representatives of different specialties pertinent to the central area of discussion, citizens sift through the contrasting evidence and develop their set of recommendations, which they submit to the process sponsor, usually local or national policymakers. Even though only a tiny minority of citizens' jury exercises aim to involve young people (Evans and Plows 2007), reflecting on this mode of engagement with Young SAGE participants aimed to reveal how this – and potentially other participative modes – could appeal to young people.

As Young SAGE participants were unaware of citizens' juries, in the second gathering I showed a recent short video[40] where South Australian citizen jury members were introduced to the process they would be going through. The video had some success in explaining what citizens' juries involved, but participants seemed to think that this mode was not for really for them and there was no enthusiasm for the example when discussing a range of science experiences:

> **Alissa: Yeah, the only [science experience] that's like exclusively [for] adults is the citizens' jury.**
>
> **Jess: …exclusively adults is the citizens' jury.**
>
> **Jess: And even still, you could still have sort of young adults like 18, 17, 18-year-olds could still do it, but it depends what you class as children and what you don't. (2nd Young SAGE gathering, 5th Feb 2017)**

This perception of citizens' juries as being only for adults did not result from a view that young people have limited capabilities. During the categorisation task of different science experiences, the group consensus was that citizens' jury participants needed more prior knowledge than for work experience placements, but less than for science competitions and research projects, which were all experiences that members of the Young SAGE group had already had. Overall, there was a limited reaction to the video about citizens' juries. However, it is not the case that young people are not interested in citizens' juries at all, as some involving young people have already been held: e.g. Designer Babies in South Wales had jurors who were exclusively young people from differing backgrounds (Evans and Plows 2007). Alternatively, there are perhaps society-based reasons for this disconnect. The positioning of young people as subordinate (Montgomery 2009) in an age-segregated (Vanderbeck 2007) and generationed society (Punch 2019) has been raised and reflected on at several points within this thesis. This normative assumption could have additionally contributed to the Young SAGE participants not seeing themselves as contributors for a non-specific citizens' jury process. On reflection, perhaps discussing a specific UK-based citizens' jury exercise more

[40] https://www.youtube.com/watch?v=t6awZEjnIWk

relevant to participants' interests would have been more revealing in how the participants would have been attracted to this type of exercise (or not, as the case may be).

However, and more pertinently, participants themselves were interested in a specific participative experience. Although the generalised idea of citizens' juries did not appeal, they were certainly sufficiently interested to invest their time in the Young SAGE project and collaborate with me. Reflecting on our introductory interviews towards the start of the project, motivations around participants' involvements coalesced around particular common themes, which reflected many well-established assertions from around participatory research involving young people (Shier 2001, Punch 2002a, Kirby 2004, Tisdall *et al.* 2008, Davis 2009, Wyness 2009, Davis 2011), yet could be important for public engagement with science exercises.

Firstly, a key motivation for several of participants seemed to be the possibility for change (see also Tisdall *et al.* 2009, Davis 2011), especially with respect to the delivery of science experiences for young people and the potential impact on interest in the sciences:

> **Well I know that I'm quite engaged in science, and I thought maybe I could provide sort of helpful information or like give discussions about that […] I just want others to be interested as well! […] …it would be nice to boost how people are engaged in science as well. (Dean interview, 7th July 2017)**

Dean spoke passionately about his own interest in science and had had some apparent concerns with how others seem to not be as interested in science. Similar motivations were independently mentioned by Alissa, Jess, James, and Luis.

Secondly, the possibility of meeting new people was also an attraction, reflecting advice elsewhere (Stafford *et al.* 2003, Kirby 2004). Working as part of a team was mentioned by several participants, but Alissa made a specific point based on perspectives of science:

> **I just want to learn how other people feel about science, like I love it and I want to know if other people feel the same way, […learn] from both young people and you, like what science means to people, that's kind of the main thing I want to learn: it means a lot to me, but I don't know if it means a lot to other people. (Alissa interview, 9th Dec 2016)**

There could be an attraction of working with like-minded others who feel similarly positively about the core subject of the project, which has been suggested elsewhere (e.g. for youth councils, Stafford *et al.* 2003) and aligns with ideas of belonging and identifying with others (Kustatscher 2015). For the Young SAGE project, there was an obvious focus on science and young people, so these elements formed a good foundation for Alissa's involvement in the project.

Thirdly, some participants thought that there could be some personal benefit to their involvement – i.e. intrinsic motivations, important for engaging young people (Hill *et al.* 2004) as well as co-production projects (Bovaird and Loeffler 2012) – which links to their ambitions after leaving school:

> **…I'm planning on going to uni afterwards and I think it's good to make connections with people and learn more about what I'm planning to do and, I mean I want to go down the sciencey path, so it would be quite helpful […] to learn more about different aspects of what people enjoy or don't. (Jess interview, 25th Nov 2016)**

Jess had a definite plan to go to university – which was an ambition held by many others in the Young SAGE team – and felt that being part of Young SAGE would help to reflect on the benefits and challenges of science that others perceived, in addition to having her own perspectives of the subject.

Fourthly, like with science experiences in general (see section 6.1.3), the novelty of being involved in a participative project held particular appeal for two participants:

> **…I've not really done anything like it before, cos like I usually just, to do a science it's just like learning it rather than getting really involved in it, so it's something different. (Helen interview, 28th Nov 2016)**

In addition to the novelty, Helen summarised a key distinction in the participative nature of the Young SAGE project when compared to 'typical' science experiences

she had had previously. The project was not concerned with learning information that others had already discovered, it was about original learning, and this difference in approach was part of its attraction.

Finally, the opportunity to be heard was important (Alderson 2001):

> **…I have never really been asked my opinion before on things that are of significance. […] it's a good opportunity for me to actually put that into motion and actually try and […] have my opinion heard which never really happens. (Laura interview, 18th Nov 2016)**

For Laura, the chance to make an active contribution where her views and thoughts would be potentially acted upon (linking to the desire to contribute to change), also seemed to have a novel element to it as well. The fact that Laura thought the topic of the project – exploring young people's science experiences – was significant may be key. The topic of any project, and the way it could align with issues that potential participants regard as personally important, is arguably the most important driver for those who become involved in participatory projects (and in fact engagement exercises more broadly).

All of these motivations could potentially apply to other participatory experiences. Therefore the apparent disinterest of the Young SAGE participants regarding citizens' juries may have stemmed from only having an appreciation of the process in a very generic sense, as well as the perception of contributors to scientific knowledge needing to be formally accepted into the field (Gieryn 1983). Although Young SAGE participants appeared motivated by the potential for experiences that involved learning or had direct benefits for their immediate plans, given the appropriate background information, they were also very interested in opportunities like Young SAGE that enabled them to contribute their own ideas and perspectives; as Mark summarised:

> **…I feel like sometimes when I've been to a few things where it's been sort of adults have thought of all the ideas about, "Oh we should teach kids about this sort of science and do it in this sort of way" and sometimes just missed the mark a bit and […] not engaged people the**

way it could have done if they just maybe thought about it slightly differently. So I thought if I went and did this [Young SAGE project] maybe it would help. It might give them [adults] some insight into what teenagers might actually want to […] learn about and the […] way they want to learn about stuff. (Mark interview, 11th Jan 2017)

6.6 Conclusion

In contrast to previous research into young people's science aspirations (Bennett and Hogarth 2009, Aschbacher *et al.* 2010, Archer *et al.* 2013), I have eschewed a survey-based approach in favour of an open exploration of young people's perspectives. Rather than using an exclusively educational lens through which to interrogate participant views about science learning (Stocklmayer *et al.* 2010), I have taken a broader approach, and therefore remained aware of other science experiences where there could be a more involved role for young people (e.g. competitions, small research projects). Taking this broad view allows my research to expand on previous public engagement with science literature which, at best, has paid only the briefest of attention to young people's perspectives in response to particular communicative exercises (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015).

Through our individual and group conversations, a key finding from my research is that participants' main purposes of public engagement with science positioned themselves as learners. Through sparking or extending interests, learning new science information, or exploring options for future careers, participants placed themselves as data consumers rather than looking to contribute to the development of scientific knowledge. Furthermore, the dimensions of science experiences – e.g. interest in topic; novelty; entertainment; etc. – appeared to have a greater role to play for individuals rather than a pure preference for a single type of experience (e.g. science lecture). These dimensions have differing levels of importance for participants (i.e. some prefer interactivity while for others it would be detrimental) which is in line with previous research (e.g. Bathgate *et al.* 2014, Mujtaba *et al.* 2018). A related finding was that having an element of choice of

experiences (or within specific exercises) appeared to have some importance for individuals to pursue their interests and to motivate their involvement particularly in more challenging and time-heavy experiences, adding to the sense of control others have noted (e.g. Stocklmayer *et al.* 2010). Interestingly, there were also examples where a lack of choice did not negatively impact how participants regarded their involvement in particular experiences (e.g. Helen's research project; Dean's space school). Thus, for science experiences to be positively perceived, experience providers should pay attention to as many of the identified dimensions as possible and reflect on how choice can be incorporated.

Additionally, I can conclude that participants took active steps to explore opportunities for building on their own interests, consequently combining their own integrated sets of experiences, demonstrating their agency (James 2009). Many participants shared examples where parents or teachers supported their involvements with different experiences, thus illustrating how notions of science capital (Archer *et al.* 2013, Archer *et al.* 2018) play a role through adult fostering of relevant capital in children and young people. However, the Bourdieusian-based idea of science capital is limited as it draws attention almost exclusively to the role of adults and excludes how young people can influence each other (e.g. advice on whether to undertake a science baccalaureate project). In policymaker circles, this limitation is demonstrated in Science, Technology, Engineering and Mathematics (STEM) Evidence Base (Scottish Government 2017), which only focuses on engaging adults (i.e. parents and teachers) in order to influence children and young people, who are consequently implied to be passive individuals. Furthermore, although the idea of science capital is beneficial in casting light explicitly on ideas around science over the original tendency to focus on the arts (DeWitt and Archer 2017), my research suggests some caution should be taken. There is a danger that this science-focus puts the wider notion of cultural capital in the shade when considering science influences: it was Jess' parents' broader cultural capital that was relevant, not their more-focused science capital. Thus, an exclusive focus on science capital may reduce attention on wider societal influences (e.g. socio-economic).

Returning to the finding that participants focused purely on past and possible learning experiences: a significant implication is that they did not readily consider experiences where they could contribute their skills and participate in the development of science knowledge. (The main exception to this was Mark's citizen science involvement, but this was solely assisting data collection and he did not have an active role in the project design nor drawing conclusions.) However, this does not mean that participants were not interested in participatory exercises at all: they became involved in the collaborative Young SAGE project due to a mixture of altruistic (e.g. possibility for broad change) and intrinsic (e.g. meet new people) reasons (Hill 2006, Bovaird and Loeffler 2012, Alford 2014). Therefore, this allows me to suggest there are two principle causes for this apparent disconnect that reinforce each other: the age-segregated, generational structure (Vanderbeck 2007, Punch 2019) of the local context imposes a marginalised status for young people that is difficult to overcome. Moreover, the special nature of science in contemporary society as the leading source of knowledge (Gieryn 1983, Yearley 2005c) implies that only qualified people can be involved in generating new discoveries.

Within Gieryn's (1983) explication of the boundary-work in establishing science and heightening its authority through favourable comparisons with competing sources, he argues that his examples:

> …illustrate several antinomies in the institution of science: scientific knowledge is at once theoretical and empirical, pure and applied, objective and subjective, exact and estimative, *democratic* (open for all to confirm) and *elitist* (experts alone confirm), limitless and limited (to certain domains of knowledge). (Gieryn 1983: 792, emphasis added)

With the disadvantage of having a subordinate status already, the claim of science being 'democratic' is less likely for young people, who may consequently perceive the possibility of being an active participant in scientific processes as an 'elitist' activity since they have yet to achieve the requirements to become more involved. To borrow from Bourdieu (1986), they don't have the cultural goods – in terms of formal qualifications – to see themselves as being able to contribute to developing

scientific knowledge. However, the shift from science-learner to science-contributor had already begun for some of the participants in this study: as well as Mark's citizen science involvement; Helen, Lisa, and Sarah had been involved in small collaborative research projects at the zoo; while Luis and Rory had led their own science-baccalaureate projects independently. Although these experiences are likely to have been perceived as benefiting personal learning, they are also contributing to the pursuit of scientific knowledge, albeit in a less formal way than participants may have envisaged, thus setting a challenge around what 'science' actually involves.

7 Conclusions from exploring public engagement with science through an intergenerational collaboration

Within this final chapter, I initially present the main research questions that have guided my analysis and explore my findings pertinent to each. Then, I turn to the implications for the literatures around public engagement with science and childhood studies respectively. Finally, I look towards the implications of my research for policy and practice, as well as opportunities for further research that this project has revealed.

7.1 Responding to my research questions: the research findings

My research began from the premise that the public engagement with science literature has greatly ignored children and young people. Although there has been brief inclusion of some views from younger attendees in studies focused on single communicative exercises (Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015), and attention to science experiences through a learning lens (e.g. Stocklmayer *et al.* 2010), there has not been an explicit focus on children and young people across all public engagement with science modes (Science for All 2010) and how children and young people can be involved now and not just in the future (cf. Archer *et al.* 2013).

This thesis, through a collaborative case study where I worked closely with 13 young people over the course of 18 months in developing an event and delivering linked surveys, uniquely explores and generates understandings that address this core gap in knowledge. Due to the lack of attention on children and young people within public engagement with science, I have looked to debates from childhood studies as an integral aspect of my research. In particular, I have incorporated the impact of generations and generationing (Punch 2019), balancing protection with supporting young people's participation (Mayall 2012), and establishing an open dialogue based on intergenerational working that does not hide the adult researcher position

(Wyness 2013). By working with these perspectives, my work also contributes to debates around participation within childhood studies (Hart 1992, Hill *et al.* 2004, Tisdall *et al.* 2008, Davis 2009, Kellett 2011, Cairns *et al.* 2018), especially the role of adults and notions of project ownership within intergenerational research involving young people.

Following my analysis of the more specific tensions that exist in the literatures in chapter 2, such as young people's views on the three modes of public engagement with science, and how issues of power and ownership affect intergenerational practice, I developed four key research questions for this study. The first two contribute to public engagement with science, while the second pair have greater relevance for childhood studies. However, my findings are applicable to both fields and are not intended to speak only to a single one.

Research question 1: What are the perspectives of young people with respect to public engagement with science exercises?

Research question 2: Within public engagement with science exercises, to what extent can young people be actively engaged and what possibilities exist for young people to contribute their skills and experiences?

For Young SAGE participants, there were different **purposes for public engagement with science** exercises, as well as a variety of dimensions which combined to affect the appeal of these. Looking first at the purposes, these were principally: to spark or extend an interest in science; to further their own learning about scientific topics; or for inspiration for their post-school options (e.g. university study). Through these purposes, participants positioned themselves as learners of information, even when they were looking to science experiences they wished to have in the future. This finding highlights how this group of young people, who were highly interested in science, seemed to be exclusively interested in learning more scientific knowledge, rather than considering how they could contribute to the knowledge-development

process. While this is encouraging for communicative modes of public engagement with science, supporting conclusions from Jensen and Buckley's (2014) science festival-based exploration, it poses challenges for consultative and participative modes in that young people may not see themselves as potential contributors to these types of exercises. However, young people have been involved in the participative mode of public engagement with science elsewhere (such as within the Designer Babies citizens' jury as analysed by Evans and Plows 2007), so there must be motivators that work on a more personal level.

The motivation does not seem to emanate from the type of engagement exercise, as there was substantial diversity in participants' preferences in my study. With examples including science festivals, YouTube videos, and competitions, there was not one type preferred over others even within this relatively small group of science-interested young people. Instead, my research reveals that rather than specific exercise types being important, there are different dimensions of science experiences which interact with each other to impact how they successfully engage young people in ways that depend on personal perspectives. As such, these dimensions are likely to explain the motivation for the young participants in the Designer Babies exercise (Evans and Plows 2007) with personal commonalities amongst participants bringing them together to form a specific public (Nolas 2015).

Based on the views shared by Young SAGE participants, the fundamental **dimensions of science experiences** are the young person's interest in a topic; the accessibility and convenience of the experience; as well as the novelty of that experience. Here, 'topic' refers to specific areas of science and science-related activity (like the 'robotics' theme in Wilkinson *et al.* 2012) rather than whole subjects (e.g. biology, chemistry, physics), since there was variability in how specific topics within broader subject disciplines appealed to participants. Furthermore, the novelty dimension is informed by other research (Boeve-de Pauw *et al.* 2018), which illustrates there is a non-linear link between the cognitive success of

engagement and the level of novelty inherent in the experience: too much novelty can undermine the actual learning taken away by those engaged.

In addition to these basic elements, there was some distinction between those that applied more to communicative engagement and those relevant to the participation mode. For communicative modes of engagement, the dimensions of authenticity (e.g. discussion with genuine scientist; visit to a scientific place), entertainment or personal connections (e.g. humour, identifying with other attendees), and interactivity (e.g. hands-on activities; messages related to YouTube videos) were also key for participants. Interactivity was a more contentious theme within the group when reflecting on face-to-face circumstances, since those who are particularly shy may prefer a more anonymous approach (e.g. attending a science lecture, where the attendee can choose just to listen), rather than the young person having to speak to an adult at a hands-on interactive stall. With respect to authentic experiences, my finding here is in accord with previous research that highlights the value perceived by adult visitors in accessing scientists through science festival events (Jensen and Buckley 2014) and wanting to hear from science experts (Fogg-Rogers *et al.* 2015). However, my research expands on these earlier works by emphasising the affective value for young people as well.

Independence was another factor that several participants highlighted, particularly for experiences that needed more time and were considered challenging (i.e. extended the learning of the young person) as the challenge itself was a potential source of motivation. However, participants also expressed some conflicting ideas around independence and consequent challenges. James reflected that science fair participants may not have produced worthwhile projects due to their lack of interest in the topic at the experience's heart, thus re-emphasising the importance of personal interest as a fundamental dimension.

Turning to participative modes of engagement, participants expressed alternative dimensions when reflecting on their involvement with Young SAGE: the possibility for change; meeting new people; another personal benefit (e.g. improving their CV);

and a chance to be heard. These findings overlap with the novelty of an experience, but also stand-alone as valuable dimensions. Although new for the lens of public engagement with science involving young people, these dimensions replicate assertions from childhood studies researchers (e.g. Punch 2002a, Kirby 2004, Tisdall *et al.* 2008), particularly calls to make the engagement meaningful (Sinclair 2004) and avoiding tokenistic projects where there is no real outcome or limited impact of young people's contributions (Hart 1992, Davis 2009). Also, it is not the notion of participation itself that is important, but what the participative process can lead to in terms of positive change and improved outcomes (Nolas 2015).

These findings combine to produce the following framework of dimensions that influence the appeal of science experiences, with personal interest, accessibility and convenience, and novelty spanning the different engagement modes:

Communication	**Participation**
Independence	Chance to be heard
Interactivity	Personal benefit
Entertainment / Personal connection	Meeting new people
Authenticity	Possibility for change
Novelty	
Accessibility / convenience	
Interest in specific topic	

Figure 11: Dimensions that influence the appeal of science experiences for young people

In addition to this framework, the **role of choice as part of public engagement with science** exercises has a variable impact for the Young SAGE participants. Having choice can enhance the enjoyment of an individual's involvement, be motivating, and can be influenced by an individual's prior interests. This finding aligns with DeWitt and Storksdieck (2008), who argue that the lack of choice in very structured school trips can reduce the possibility for positive impacts on children and young people. However, the impact of choice is more nuanced than this: for Young SAGE participants, choice was not always important at every single stage of an experience (e.g. Helen's animal in the zoo research project; Alissa's requirement to make only

notes during her work experience), especially when the young person had chosen to be involved in the first place or they would have made the same choice anyway (e.g. Dean's space school programme). In combination with the dimensions of science experiences, these findings suggest that those developing science experiences ought to reflect on how choice can be incorporated and enabled. Choice may not be necessary, but the lack of choice may be resented, particularly by those who may not have a strong interest in the topic at the heart of the experience.

To **enable their engagement**, participants also highlighted how their parents and teachers had supported them with accessing new science experiences and supported their developing plans for the future aligning with assertions made around science capital by Archer *et al.* (2013). However, it was not the case that all participants had parents who were explicitly interested in science themselves: Jess revealed that her parents had been (and continued to be) supportive of her changing plans for her future and that it did not matter what her interest was. This finding is problematic for the notion of science capital, as it was the family's cultural capital (Bourdieu 1986) that was more important, since Jess' parents had enabled her to access experiences – like the local science festival – that supported her own interest that she was developing through related TV programmes and books. Although the notion of science capital can be helpful in considering the science-related influences on young people, my study illustrates how this should not be allowed to obscure the wider notion of cultural capital.

Additionally, Young SAGE participants also illustrated how adults are not the only influencers on them. Luis' decision to undertake his science baccalaureate research project was an option offered by his teachers, but a discussion with a fellow pupil from the year above was an important element in his decision to get involved. This finding expands on the possible influences that science capital offers (Archer *et al.* 2013, DeWitt and Archer 2017). Bourdieu's (1986) articulation of cultural capital as something developed within offspring over time through parental support is the foundation for Archer *et al.'s* (2013) idea of science capital, which emphasises adult

influences on young people (i.e. from family members and teachers). However, this is a limited perspective as it overlooks the possibility for children and young people to influence each other as well and downplays their agential status (James 2009).

Depending on the specific purpose of a public engagement with science exercise, the possibility for **active contribution and influence on others** is potentially important, especially in terms of young people actively using their skills and experiences. Returning to my earlier finding, although participants in the Young SAGE project positioned themselves mostly as learners in their past and desired science experiences, many were already in the process of contributing to the development of scientific knowledge through their involvement in competitions and small-scale research projects. Therefore, despite academic and policymaker dialogue moving on to recognise the capabilities of children and young people as active contributors (Prout and James 1997, Woodhead 2008, Powell and Smith 2009, Tisdall and Punch 2012), I have discovered that further attention needs to be given to filter this message through to children and young people themselves.

Research question 3: What are the issues and implications of the power dynamics present within an adult-instigated intergenerational project and how can these be addressed?

Research question 4: Within an adult-instigated participatory research project, how do young people demonstrate their agency and how do they re-mould the project as it progresses?

As I have shown – primarily through chapter 4 – in an intergenerational collaboration instigated by an adult, there are a range of subtle and more obvious applications of power that ensure the role of the adult is different to those of the young participants. Consequently, I add my voice to calls elsewhere to explicitly reflect on the role of the adult in research involving children and young people (Gallagher 2008, Mayall 2012, Wyness 2013) and for more explicit attention on the

notion of generation and to raise this alongside other social orders such as gender and ethnicity (Punch 2019). In the Young SAGE project, for example, I had what I term **'markers of difference'**, since I coordinated the arrangements for our gatherings; had formal responsibility for ethics commitments; and was treated as a specific sounding board by participants and in an advantaged way by other adults (i.e. teachers and stall providers) engaged through the project. This finding questions the notion of child-led research that has arguably been a goal of childhood studies, especially based on the problematic reading of Hart's (1992, 2008) ladder of participation as having higher rungs to which all childhood research should reach. Despite my aim to only *support* participants' efforts within the Young SAGE project, it was impossible to resist having a *prominent* role in the group as well. Although I aimed to attend to the practical coordination elements of our collaboration to release participants to progress and mould the project (Davis 2009), being the coordinator (as well as project instigator) reinforced my central position in the group, endangering the more-even power dynamics required for genuine collaboration.

Although this finding seems intuitively appropriate and somewhat obvious, it is important to highlight that markers of difference exist – from the viewpoint of the adult, as well as the young participants – since they will have influenced the perceptions of all collaborators (me as an adult, as well as the Young SAGE participants) on their roles in the project. Thinking reflexively (Greenbank 2003, Basit 2013), there were other **contextual influences** (e.g. my event-management experience, PhD timeline) and **researcher tensions** (e.g. balancing confidentiality and other ethical demands against participant choices) that impacted on my role in the collaboration and the attendant power dynamics of the group. These influences and tensions combine to further question the foundation of child-led research (Kellett 2011, Cuevas-Parra and Tisdall 2019) and support the argument of Lohmeyer (2019) that participant-led projects in formal adult-instigated scenarios are not possible: "…there is a need to accept that some of the power asymmetries of participation might be unsolvable" (Lohmeyer 2019: 1). For example, within

formal research, a 'child-initiated and directed' project (Hart 1992) would never be a realistic possibility due to procedural ethics requirements (Guillemin and Gillam 2004, Tracy 2010): within Young SAGE, a foundation had to be approved before my participant recruitment could begin, and ethics commitments can oppose participative working approaches throughout a project's duration.

Nonetheless, adult researchers need to be aware of the group power dynamics and work reflexively to minimise the privileges that they are likely to assume, as well as be granted by their young participants. Markers of difference, contextual influences, researcher tensions and how these influence the project all need consideration by the adult researcher. If not, there is a significant risk that the partnership is collaborative in name only: the adult would be actually taking a directive approach. While being directive may fit with the expectations of young participants from a generational viewpoint as they are usually subordinate in relation to adults (Mayall 2015, Punch 2019), this positioning sits in tension with the notion of collaboration. Although Franks' (2011) proposal for "pockets of participation" appears to offer a constructive solution by offering the opportunity for young participants to select elements of a project they wish to undertake, what this risks is embedding the adult into a central position and is unsuitable for collaborative working where there needs to be organic development as the project unfolds: it is impossible to predict all future possibilities.

Therefore, to enable genuine collaboration, this thesis has instead explored how the notion of project ownership (Hanauer *et al.* 2012) among participants can assist in addressing normative generation-based power dynamics (Vanderbeck 2007) and brings attention to how young people can exercise their agency (James 2009) and mould a project. However, what is missing from the project-ownership framework proposed by Hanauer *et al.* (2012) – based on Wiley (2009) – is that for intergenerational collaboration there is an explicit need to **foster ownership within young participants**, due to normative adult-young person expectations. This finding is reflected in the Young SAGE project even within small actions such as deciding on

the group gathering rules, as well as when and where gatherings were held. These subtle indicators of ownership build and reinforce each other in ensuring participants gain greater responsibility for the project. However, participants do not need to develop everything from scratch, which supports Ozer *et al.* (2013), who demonstrate that participants may develop a sense of ownership over a research topic that they have not chosen for themselves. For example, although I raised the possibility for my group name and logo to be changed, this offer was completely rejected by the group, and through this action participants adopted these elements of the group's identity, enhancing their emotional connection to the project (Wiley 2009, Hanauer *et al.* 2012).

The adult must consider what is best for their **own research context and work with their young participants** to enable their perspectives to take an active role. This is not the same as empowering participants, a concept which treats power as an entity to be transferred (Gallagher 2008) rather than being realised through actions and reactions (Foucault 1980). For example, participant training is a contentious topic within childhood studies, and impacts on how ownership is distributed between the adult and young participants. Although many researchers insist that training is essential to enable research to be carried out appropriately (Lansdown 2001, Kellett 2005, Burton *et al.* 2010, Kellett 2011, Bradbury-Jones and Taylor 2015), particularly to address potential power inequalities resulting from a disparity of previous knowledge among participants (Cahill 2007), my research suggests that adult researchers ought to pause and avoid imposing training unreflexively. Whilst others have critiqued the need for training on the basis that young participants could be overly influenced by taking on adult-based approaches (Kim 2016), or be exclusionary for those who are less academic (Brownlie *et al.* 2006), I additionally argue that imposing training undermines the co-productive foundation that collaborative research stands upon (Bovaird and Loeffler 2012). An alternative approach, which enhances the sense of ownership within participants, is to discuss needs with participants and include them in these larger decisions, recognising and embracing their skills and viewpoints. This does not mean that the adult abdicates

any further exploration of the implications of these choices: in Young SAGE, I remained active by softly questioning the later decisions of the participants, which led to justifications or adjustments as participants deemed necessary (i.e. reflecting on the surveys we produced in the group).

An important finding of my research, but one that could be easily overlooked, is how **the use of pronouns reflects the sense of ownership** that participants feel towards the project; a finding that supports the assertion made by Hanauer *et al.* (2012). Towards the beginning of our collaboration, participants' use of second-person pronouns – i.e. 'you' – gave the impression that the project was mine and that participants were seeking to assist *me* with *my* work. Over time, the dynamic changed with greater participant use of first-person pronouns – i.e. 'I' and 'we' – in referring to *our* project. This finding reflects the success of the discussion-based approach of the Young SAGE collaboration in fostering ownership within participants, and is valuable for other researchers working in this way with young people.

However, it needs to be recognised that the **notion of ownership is highly personalised** and can be enacted in different ways by different participants, again illustrating the agential status of young people to choosing how and when to act (James 2009). Megan, Dean, and Alissa were more active and vocal in their involvement during the project, with each leading in different ways. For example, although Alissa was a less frequent attendee, she sought to clarify the direction of the project when she was available. Dean established a greater leadership role in determining what the group needed to attend to, despite not being involved from the very outset of the project. Therefore, it is not only the more experienced group members that can take leading roles, which stands in opposition to the experience of Ozer *et al.* (2013). But leadership is not the same as ownership: other participants took on specific tasks (e.g. Emma's design of the group T-shirt) that outwardly demonstrated participants' commitment to their project, as well as contributed to discussions within gatherings that shaped the project plan. In doing

so, participants demonstrated their agential statuses, through choosing and negotiating their individual roles in the project (Punch 2016). There is variety in how individuals feel ownership: Mark still referred to the project as 'ours' in the final gathering, despite not taking an overtly leading role in the group.

The personalised nature of ownership was also reflected by my own actions within the collaboration. As previously highlighted, I did not want to impose my thoughts based on my past event-management experience and become too directive. Although I thought the project plans – several surveys linked to a bespoke event – were too ambitious, equally I did not want to stifle participants' creativity and innovation. This caused some hesitation in knowing how to act beyond the in-person gatherings. Open face-to-face communication during our gatherings assisted my understanding of the support participants wanted, but in-between gatherings this was more challenging to assess. By liaising with the event stall providers, I felt that I had taken over ownership of this part of the project, however participants did not interpret this action in the same way and considered this only as supportive of their efforts, in a similar way to how the young people in Larson *et al.* (2005b) interpreted the event-coordination actions of their supportive adult. Therefore, my research further underlines the value of open and honest communication in collaborative contexts to ensure that actions are appropriate and acceptable, and to avoid the risk of the adult acting in ways that takes ownership away from younger participants (Kellett 2005, Larson *et al.* 2005a). In so doing, my study reinforces the suggestion that ownership is context-dependent (Wiley 2009, Handberg 2018) and there is no abstract perfect approach to co-production (Alford 2014): it depends on the people involved and how they exchange power through their actions and reactions (Foucault 1980, Gallagher 2008).

Finally, the work in this thesis illustrates **the distinction between intergenerational relationships within a group and those in wider society**, re-emphasising the generational nature of Minority World societies (Punch 2019). Participants had limited success in engaging new adults beyond our group (e.g. event stall holders),

but within the group we overcame some of the generational power dynamics that infuse normative adult-young people relationships. In some ways, this distinction reflects Bourdieu's notion of capital within our own micro-society. We built our own sense of 'group-cultural' capital over time: as Bourdieu (1986) articulates, cultural capital cannot be directly gifted from one person to another, it cannot be obtained second-hand, it is personally developed over time usually in unconscious ways. Consequently, an important element of intergenerational collaboration is time. As the Young SAGE project has highlighted, stating a desire to work together is an important foundation, and acting in a way that respects participants' inputs is another, but time is a further crucial factor to enable participants and the adult to overcome normative understandings of child-adult relationships, appreciate that all can learn from everyone else – including adults learning from the participants (Kirby *et al.* 2003) – and genuinely collaborate. This is an important finding for debates in the literatures, to which I now turn.

7.2 Implications for debates in the literatures

My four research questions outlined in the previous section have guided my analysis of my Young SAGE project. Here, I discuss how my research contributes to specific areas of debate within the bodies of literatures around public engagement with science and childhood studies, which have underpinned my work, as well as advancing a new conceptualisation for participative public engagement with science involving young people.

7.2.1 Implications for public engagement with science: involving children and young people

Rather than taking a narrow view by exploring perspectives on a single public engagement science format (e.g. Wilkinson *et al.* 2012, Fogg-Rogers *et al.* 2015), this study has opted for a more open stance through using opportunities in a

collaborative context to explore young people's narratives around how they have personally engaged with science and continue to do so.

Primarily, this study has reflected substantial endorsement for communicative forms of engagement through participants' positive reflections of their past experiences and a joint ambition within the Young SAGE project to investigate the outcomes of a bespoke interactive event aimed at younger people. Wading into intense philosophical debates about the persisting continuation of the deficit model (Cortassa 2016), my study reminds us of the importance of understanding the engagement motivations for those involved. Whereas the deficit model critique rests on the notion of a disinterested homogeneous public (Bucchi and Neresini 2007), Young SAGE participants had significant personal motivations for engaging with science. Many participants wanted to continue their learning of science-related topics beyond school with several putting together their own combinations of independent experiences that aligned with their personal interests, which were themselves diverse. As chapter 6 illustrates, participants expressed specific interests in a range of science-related topics. Thus, although these topics fall under the broad label of science, participants negotiated their own paths and determined their own collections of experiences, often with the support of others, particularly family members and teachers. These actions of Young SAGE participants move us away from the notion of 'parachuting' (see section 6.3.1) which focuses on the limited impact of individual science experiences, rather than viewing the experience from the perspectives of those engaged (like I have within my research). The experience will be one out of a substantial number that an individual will have, and they are potentially capable of combining diverse experiences for themselves.

However, it was not the case that participants were solely interested in communicative engagement. Despite being the most prevalent engagement mode – due to participants' emphasis on opportunities to learn and desiring introductions to new knowledge that went beyond school-based experiences – Young SAGE participants had already had more involved experiences as well, such as research

projects. However, the overwhelming sense was that these experiences were not regarded as contributing to the process of science as an academic enterprise, but as another opportunity for personal learning and development, perhaps assisting post-school ambitions.

Consequently, there is a need for those involved in planning consultative and participatory modes of public engagement with science to actively reflect both on the driving motivations of young people, as well as the power dynamics that affect engagement processes. Through a brief exploration of the notion of participation (by discussing citizens' juries), in combination with the participants' focus on learning opportunities, this study has drawn attention to a potential lack of confidence in young people about their underlying potential to offer insightful contributions to participative exercises. Therefore, it is likely that other young participants require active reassurance that their contributions are valued and valuable. We addressed these challenges within the Young SAGE project, which serves to illustrate that within any specific process that involves only young participants there needs to be careful encouragement that their views are important. Given reflections regarding young people's marginalised status in wider society (Qvortrup 2005, Montgomery 2009), a participatory process that also involves adults as participants is likely to need even greater attention on ensuring that any young people are enabled to actively contribute. Of course, I do not wish to suggest that every individual young participant will need additional support, only that it is more likely due to the structural age-segregated norms pervading Minority World societies (Vanderbeck 2007).

Still, the same suggestion of additional support could be made for any marginalised grouping or community. The obstacles affecting Young SAGE participants' reflections on how they were learning about science, despite examples of their own potential contributions to the process of science, could also be reflected by other groups that are side-lined in wider society. As the research by Dawson (2018) suggests, there are other elements of identity – such as socio-economic status and

ethnicity – that impact on whether individuals feel that the idea of engaging with science is for them. Findings developed by Kennedy *et al.* (2018) around the limited socio-economic diversity of people attending UK science festivals reinforces the notion that some people are not adequately engaged by standard engagement formats. However, there is perhaps a need to turn this issue around: instead of only questioning how to expand the diversity of people engaged through specific formats, perhaps parallel effort needs to be made into exploring how people engage with science in different ways. Within Young SAGE reflections, online science videos were not actively used in an obvious way by many of the participants, but this may reflect their own set of backgrounds and influences. By way of contrast, Dawson (2018) suggests that TV was regarded as an accessible way of engaging with science (albeit only in a communicative way) by adults who had recently immigrated to the UK and who were generally of a lower socio-economic status. Perhaps there is a need to explore how broadcast and online engagement formats can be used more actively to broaden opportunities for engagement with science.

The encouragement for young people (and perhaps any marginalised group) in their involvement with participatory processes is partly due to the decisions around those organising such exercises, but also about the positions that the (young) participants themselves take, which relate to their self-perceptions on their abilities to contribute. These tensions overlap with the childhood studies literature, so it is to that which I now turn.

7.2.2 Implications for childhood studies: embracing intergenerationality

This study contributes to notions of intergenerationality that have emerged in the childhood studies literature based on the argument that it is impossible to ignore the role of adults in formal research with children and young people (e.g. Mayall 2012, Wyness 2013, Punch 2016). In particular, the emphasis on the role of the

adult, as well as intragenerational concerns, illustrates the role of power that pervades this type of collaboration (Punch 2016). Consequently, this study underscores the impossibility of 'child-led' research within formal research processes, aligning with the critique developed by Lohmeyer (2019) based on his research in an Australian context. The potential for child-led research is reduced to nil by requirements to adhere to adult-developed regulations in tandem with the impact on children and young people of their normative subordinated status in wider society.

By association, and in spite of any commitments from adult researchers to foster project ownership within young participants, there are significant structural obstacles that challenge the possibility for participants to gain or acquire ownership. For example, I aimed for Young SAGE participants to make key decisions in the progression of the project, but there remained an onus on me to ensure we adhered to ethics committee requirements. Unfortunately, this adherence was not a one-off event: due to the open-nature of the Young SAGE collaboration, there were several formal contact points (see section 3.3.7.2) that contributed to my distinct status in the project. Although I discussed the points from the ethics application with participants in developing responses to the procedural ethics points, the responsibility remained on me to ensure the administration was successfully completed and the pressured time for later applications limited the opportunity for participants to provide their inputs (see also Yanar *et al.* 2016).

Furthermore, the restrictions on being involved in specific aspects of the project like research administration was compounded by wider societal influences. Young people are regularly reminded of their place in society, as a person who is able to act and contribute within specific adult-determined times and locations (Ennew 1994, Qvortrup 2005, Vanderbeck 2007). My status as a university student/staff member, from a protectionist viewpoint (Lundy and McEvoy 2012, Daley 2015), may well have offered a heightened level of trust for participants and their parents. However, this status may have also raised the spectre of a space where young

people would expect to be directed in their actions by the adult, especially in more formal scenarios – just like Young SAGE: a research project where in-person gatherings took place on university property. Although participants appeared keen to be involved on this basis, there was perhaps a risk that participants viewed the university as a place of learning (based on all participants seeking further- and higher-education options after leaving school) and thus 'naturally' reverted to aspects of a teacher-pupil dynamic. Furthermore, the university brand and the idea of formal research, although attractive to those who participated in my research, may have been perceived negatively by other young people, thus limiting the diversity of those involved in the project.

However, the implications of this age-segregated approach did not completely obliterate possibilities for participants to take ownership of project elements. Akin to claims around agency being more than a binary entity (Punch 2016), and participation not being binary (Arnstein 1969) – a position that instigated attempts to develop spectrums and overviews of how variants of participation differed (Hart 1992, Shier 2001) – my research suggests that the notion of ownership is also more nuanced than a have or have-not question and is dependent on the perspectives of those involved. At times, I feared I was taking ownership of the project away from participants through expanding the range of event-related tasks for which I was responsible, this fear seemed not to be reciprocated by participants, who – like the participants in Larson *et al.* (2005b) – perceived my expansion of tasks as supportive and not obstructive or directive.

The Young SAGE project has also illustrated the need for adult researchers seeking collaborative approaches with young participants to reflect on their approaches in engaging their collaborators. Some structural requirements – like formal ethics boards – are undoubtedly challenging for the notion of collaboration as they reinforce a distinct status on the project instigator. However, there are others that should be questioned. During my project, this can most prominently be seen in the approach to training. A commitment to collaboration is a commitment to viewing

power as fluid and not as an exchangeable entity (Foucault 1980, Gallagher 2008): after some discussion, Young SAGE participants did not want training to support their project. Although others argue that training is required to address power imbalances between all those involved (Cahill 2007, Kellett 2011), my research enhances the counter-argument that insisting on training in collaborative projects only serves to reinforce existing power disparities when working with marginalised groups like young people (Kim 2016) through taking decision-making out of participants' hands, and ignores the premise of co-production on which collaboration is based (Bovaird and Loeffler 2012).

These experiences, amongst many instances of tension, highlights the importance of giving greater attention to intergenerational research, with this thesis making a positive contribution to understandings around collaborative working. Thus, the flawed idea of 'child-led' research in formal contexts should be put to one side and intergenerationality embraced with greater enthusiasm, as this better reflects reality and offers an appropriate way to move knowledge of childhood forward.

7.2.3 Implications for participative public engagement with science involving young people

As my thesis is based on the premise there has been scant attention on the roles and potential contributions of young people within public engagement with science exercises, I now offer a novel foundation for future attention to this gap in knowledge. Bringing together several of the key findings discussed throughout my thesis, I propose the conceptualisation for co-production engagement with science involving young people depicted in Figure 12 on the following page.

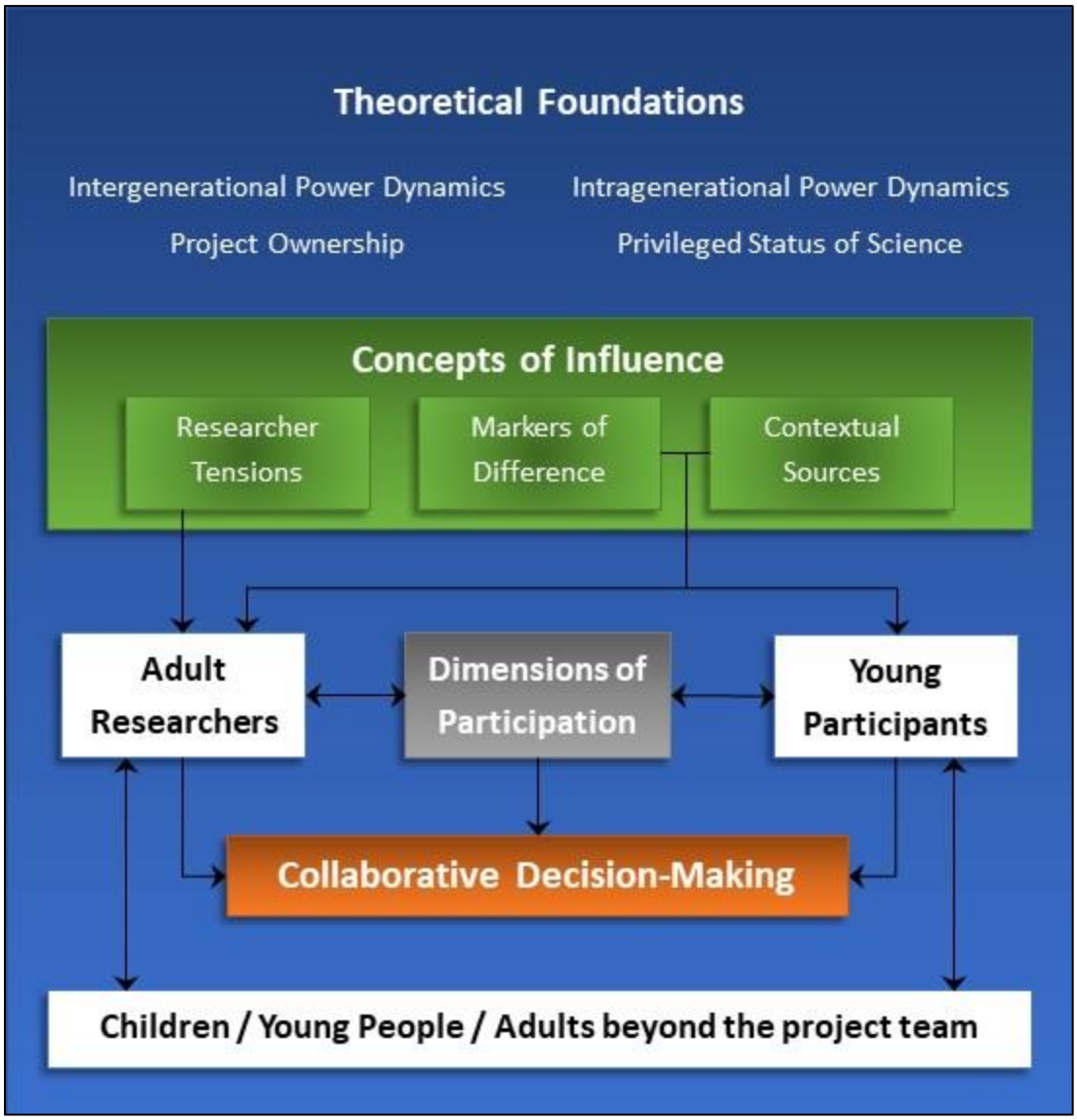

Figure 12: Framework for co-production engagement with science involving young people

The Theoretical Foundations, particularly intergenerational power dynamics and project ownership, have been core to discussions throughout my thesis. These foundations infuse every facet of the collaboration (indicated by the entirely blue background), including how adult researchers and young participants approach the engagement exercise, as well as how they interact with others beyond the immediate project team. The privileged status of science (Gieryn 1983, Yearley 2005c) demands inclusion as this is likely to compound intergenerational power dynamics in limiting young people's own perceptions of their contributory potential to the practice of science. Furthermore, these Theoretical Foundations directly

affect specific Concepts of Influence: Researcher Tensions (e.g. formal ethics commitments) primarily affect the adult researcher, while Markers of Difference (e.g. practical organisation) and Contextual Sources (e.g. other priorities) affect both adult researchers and young participants. With these notions underpinning their association, adults and young people within the engagement exercise work with each other through the Dimensions of Participation (discussed in section 7.1) in a process of Collaborative Decision-Making about their project, such as choices around training needs and provision. Depending on the goals of the specific project, there is also the potential for adult researchers and young participants to influence, and be influenced by, people beyond their ongoing collaborative project team.

It ought to be recognised that this conceptualisation is provisional, as it is founded on, and greatly informed by, the generational focus of my research (Alanen 2009, Punch 2019). With childhoods themselves being affected by other social orders – such as gender, race, class, geography, etc. (Konstantoni and Emejulu 2017) – there is significant potential to expand on the Theoretical Foundations through further research on co-production forms of public engagement with science involving young people.

7.3 Implications for policy and practice

As Punch (2016) suggests, there remains a distinct divide between positive notions of children and young people as agents capable of contributing to wider society and the limited opportunities for them to formally participate. In Scotland, there have been developments in addressing this disparity, but progress has argued to have been slow (Tisdall *et al.* 2008) and there appears to be variability in this recognition. For example, the City of Edinburgh Council's decision to recognise the right of young people locally to take part in the Climate Strike in early 2019 (City of Edinburgh Council 2019) reflected an increased embrace of children's rights. However, this decision has appeared to be scaled back in a more recent announcement with the warning that the "...potential for adverse risk to children who are absent and

unsupervised is high and runs counter to child protection and raising attainment" (BBC News 2019). Thus, the distinction between academic debate and policy enactment is reinforced in one simple council-spokesperson comment. The notion of the helpless young person in need of protection remains alive and well, restricting participation and agency in the same moment. The potential to avoid longer-term harm of young people remains prioritised through the perceived more immediate need for education. Sometimes, children and young people are perceived as adults-in-waiting (Woodhead and Faulkner 2000, Wyness 2009) and the priority is on their futures. There is an implied fear that (some) young people will take advantage of the strikes to just be absent from school: it is unlikely if adults were striking, the same implications would be touched upon, despite the possibility for (some) adults to take advantage in similar ways (e.g. extra day off from work).

The idea of Climate Strikes is also a useful vehicle to reflect on young people's potential involvement within developing scientific knowledge. Contributing towards acquiring scientific evidence is not touched upon by young people within climate discussions: the majority of strike participants – if not all of them – have not been involved in data-gathering or analysis. In this way, the privileged position of science as the leading source of knowledge in society remains intact (Gieryn 1983). Instead, what the strikes reveal is the significance of the topic and the political touch-paper that this has lit. If realised, the implications of the changing climate are far-reaching and prolonged for humanity, affecting the planet for generations. This has struck a chord with sectors of society, including groups of young people, which serves to challenge the idea that "Children have very little of the social or cultural capital that might enable them to be taken seriously, *or take themselves seriously*, as political players" (Thomas 2007, emphasis added). The perceived importance of the climate change issue has motivated a number of young people to overcome their societal disadvantage and to engage beyond their adult-determined spaces.

For participatory processes – if we are serious about incorporating views from all sectors of society into the progression of science (Stilgoe *et al.* 2014) – there is thus

perhaps a greater need to react positively to opportunities to engage young people on their own terms, rather than trying to instigate projects, determine the underlying foundation, and then bring young people into the process; the approach that was utilised for Young SAGE. Recruitment processes for formal research projects involving young people are rightly argued to limit the diversity of those involved (Thomas 2007): for example, those who are better behaved and more academic are part of school pupil councils (Lewars 2010). This has further implications for public engagement with science, which is argued to not reach audiences that are representative of the general population: they are usually of a higher socio-economic status, have an existing science interest, and have strong opinions (Sturgis 2014). More recent research emphasises the barriers that socio-economic status provides in terms of practical limitations (e.g. clash of engagement opportunity with paid work) and cultural capital (Dawson 2018, Kennedy *et al.* 2018). If the goal is for greater participation of publics within the development of scientific knowledge and its implications, perhaps by starting from where young people are, there can be greater potential for young people from more diverse backgrounds and characteristics to participate.

Casting my eye to formal research processes, the challenges of attempting to appeal to diverse participants was compounded by the formality of the ethics committee process itself, supporting critiques articulated by others (e.g. Yanar *et al.* 2016, Lohmeyer 2019). Within my Young SAGE experience, the flexibility required for collaborative working was undermined by the relative rigidity offered by a multi-page application that had to be edited and re-submitted to reflect new stages of the project as it developed. The lack of having a baseline application to which additional information could be added made it more difficult for me to suggest that participants might be involved with updating ethics applications. Perhaps this difficulty reflected my own hesitancy in how to involve participants and avoid putting too much on them (see Shier 2001), but it was also a process that I thought was impractical: why was there a need to repeatedly provide the same information when the original application was already on record? Since I perceived this ethics

process to be flawed, in combination with time pressures on progressing the overall project (like Yanar *et al.* 2016), I chose to keep responsibility for updating the project's ethics applications. Thus, ethics application processes may need to be re-considered in order to provide greater potential for participants to more actively contribute to their compilation and submission, rather than there being no true alternative beyond the (adult) researcher undertaking this task.

Finally, with respect to science experiences for children and young people, public engagement practitioners could provide greater awareness of activities that relate to their specific engagement topic. (Based on the learning from the Young SAGE project, specific practical advice for those developing interactive activities has been developed in collaboration with participants, see Figure 9 and Figure 10 in section 6.4.) This would strike a middle-ground between the development of rigid programmes and the absence of ongoing support that forms the basis of the critique around 'parachuting' experiences. Young SAGE participants revealed a rich variety in their interests, how they engage across multiple different formats (e.g. talks, interactive activities, competitions, online videos, citizen science, etc.), and the role of others in supporting or providing access to experiences. Through sharing their awareness of related experiences, public engagement practitioners would be recognising the agency of young people and enabling them to decide how they wish to further their interests. Given the reflections Young SAGE participants shared on their own experiences, providing prescribed programmes of activity may not be suitable for all, but the possibility of choice is a potential motivator for some.

7.4 Implications for further research

This research has begun to explore young people's ideas and insights around public engagement with science through reflecting on their science experiences (past, present, and possible future) and collaborating on the development of a communication-based event for early secondary school pupils. The Young SAGE project has produced dimensions of science experiences – those applicable to

communicative engagement and others more suited to participatory engagement. However, these dimensions have been developed within a collaboration involving a small group of young people in a specific place and time. Reflecting on these dimensions with other young people of differing ages and/or locations may provide improved insights into the significance of these suggested notions.

Alternatively, a similar project could be run with young people who are not actively considering college or university study. For Young SAGE, the prominent indications of a university-based project could have added to the appeal for the participants involved, but also may have discouraged others through an implied message of formality or other personal views. Exploring science experiences with young people who do not have plans for university study may offer insights into differences around what is valuable (or not) for their experiences; for example, would there be greater focus on in-school or online engagement examples? Concurrently, this type of project would enable comparisons to be made for intergenerational projects in terms of any challenges for the adult researcher as well as issues of project ownership: are similar points of tension within Young SAGE encountered once more for the adult and the young participants and does attending to project ownership (Hanauer *et al.* 2012) – including specifically fostering ownership in participants – address these tensions?

Furthermore, exploring the dimensions of science experiences with marginalised communities away from solely considering age or generation (i.e. based on socio-economic status, ethnic backgrounds, etc.) could offer improved insights into how different groupings are actively and passively discouraged from engaging with science. Some studies have started to explore this idea through understanding the impact of socio-economic influences on (non-)attendance of science festivals and museums (Dawson 2018, Kennedy *et al.* 2018). However, further research ought to be undertaken to improve understandings on how engagement with science – which directly and indirectly affects so much of modern life – appears to currently exclude some sectors of society. For example, DeWitt and Archer's (2017) survey-

based study suggests that black secondary-school pupils are less likely than other groupings to go to museums and zoos, but more likely than others to engage with science in schools and through 'everyday' experiences such as TV programmes and online. Further research can therefore expand the focus into other modes of public engagement with science beyond a single focus on the communication mode, in particular exploring whether efforts to foster project ownership in collaborative approaches are similarly beneficial. On a related note, additional attention should be paid to how other social orders beyond generational (e.g. race, gender, geography, etc.) can improve my provisional conceptualisation of co-production-based public engagement with science involving young people.

7.5 Concluding remarks

Initially, this research project embarked on a journey to explore young people's insights into public engagement with science through a collaborative intergenerational project. As this project developed, increasing attention was given to the actual process of the research itself and my role as an adult researcher learning the craft, as well as illustrating how differing perceptions of project ownership can lead to tensions in how the project is undertaken. As such, I also make a methodological contribution to both childhood studies and public engagement with science.

My study has especially highlighted the significance of structural demands on formal research approaches that contribute to limiting the extent to which young participants can take project ownership. It has also revealed how young participants are able to overcome some of these obstacles, collaborating with an adult researcher towards a plan they have developed. Furthermore, the Young SAGE experience has highlighted how normative expectations within an age-segregated society can affect the intergenerational working within a specific project. For example, a reflexive process was important to foster a sense of ownership within

participants and overcome the notion that the adult researcher alone would define the key project goals.

On a personal note, this project has challenged my notions about research and how it is undertaken. Although my fundamental approach to the overall project has always been to have young people's insights at its heart, it has been a struggle to move completely from the black-and-white positivistic worldview that my previous science-based background has fostered. Therefore, this thesis reflects aspects of my own development in understanding research that deals with bias head-on rather than overlooking how personal beliefs affect the process of knowledge development. That this thesis includes two substantive chapters focusing on issues related to power dynamics – namely chapters 4 and 5 – and only one about public engagement with science, emphasises how my interests have developed alongside the research itself.

At the start of my research, there was a clear gap in knowledge around public engagement with science involving young people. At the end of this project, based on closely working with an enthusiastic and committed group of young participants, I have supplied substantial contributions to understanding young people's perspectives around their engagement with science, and revealed how their motivations for engagement informs their preferences. Through my exploration, I have focused on intergenerational power dynamics and attended to these through notions of project ownership. However, this thesis serves as a starting point; I have merely scratched the surface of the exploration that can be undertaken, particularly in terms of young people's identities and how these influence their enthusiasm (or otherwise) for engaging with science.

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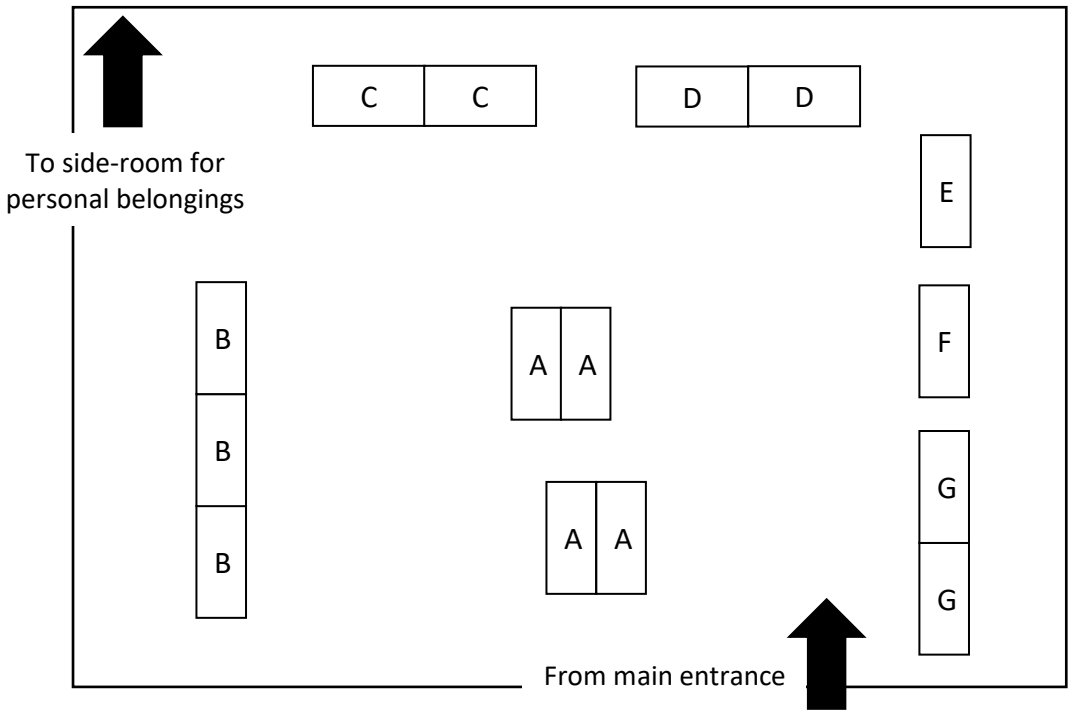
Appendices

Appendix 1 – Young SAGE event overview

The Young SAGE event was held in a local community venue known (and used) by several of the project participants. This location contrasts with many other science engagement events which are typically held in prominent cultural institutions or educational establishments (see Kennedy *et al.* 2018). Two sessions were held for early secondary school pupils: one in the morning and a second in the afternoon.

On arrival, pupils first stored their possessions in a side-room, and then returned to the main venue space. At this point, two of the Young SAGE participants introduced themselves and welcomed the visiting pupils to the event. Pupils were instructed to explore the activities throughout the space as they wished: either individually or within small groups of their choosing.

The sessions ran for 65-80 minutes, with pupils able to freely move around the venue and the Young SAGE participants who were present interacting with pupils from time-to-time. There were a mix of chaperoned and unchaperoned activities:



Key:

A. Four tables with a selection of unchaperoned SCI-FUN Roadshow exhibits (mostly to do with sensory perception and illusions, as well as some physical puzzles) with instructions and background information on printed panels.

Stalls B-G were provided and chaperoned by event partners who stood behind the tables:

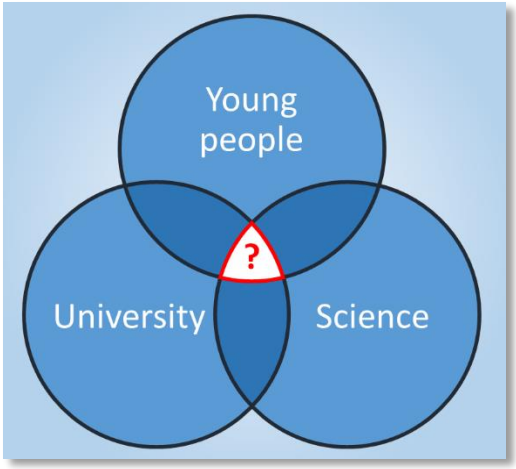
B. Three tables with forensic-anthropology and crime-investigation materials.
C. Two tables with neuroscience-themed activities.
D. Two tables with exhibits linked to soft-matter physics (e.g. biofilms).
E. One table with a single food-science experiment.
F. One table with a colour-changing slime investigation.
G. Two tables with space-related materials.

At the end of the event, teachers gathered the pupils together, and left the venue.

Appendix 2 – Young SAGE information / application form

[Thesis note: the layout has necessarily changed from the original to align with thesis-writing formatting guidelines]

Young SAGE: information and application form



Please read the information below. (Apologies in advance: some of it is quite official sounding…!) If you'd like to join, please complete page 3 and get the form signed by a responsible adult too.

Current project title: Young SAGE (Young Science Advisory Group for Engagement)

Who am I? My name is Stuart Dunbar and I work at the University of Edinburgh.

What's this project about? An exciting new initiative at the University of Edinburgh, where we will explore what young people think about different science experiences.

What are 'science experiences'? Whatever you think they are! We'll start with your ideas.

What is the main aim? To find out your ideas (potentially!) about the University's science experiences for young people, so that it can do more of the positive things.

Who will be involved? The group will include about 8-10 S4-S6 pupils from different schools in Edinburgh and possibly the Lothians.

What will this young person group do? I'll work with the group, sharing ideas and deciding together what and how we should do things. Some possible ideas are:

- Have regular one-hour gatherings (e.g. every six weeks in a year).
- Work together on a plan to explore the views of young people (we can adjust this plan later).

- Investigate existing science experiences for young people.
- Develop our own science experiences for young people.
- Probably combine lots of your ideas!

Will there be any recordings?

1. Voice-recordings of our gatherings, so I don't miss anything.
2. Possibly, a record of your own ideas, as I will be interested in your thoughts about the group and what we do. (You don't have to though.)
3. Finally, I would like to chat with each group member at different points throughout the project; preferably this will be voice-recorded too.

Will anyone outside the group find out what has been said? Everything collected during the project will be securely protected following University guidelines. Only myself and my project supervisors (Prof John Davis and Dr Eugénia Rodrigues) will have access. The details on your application form (on page 3), will be kept securely to everything else.

What about including names in reports? To protect your identity, your real name will never be used. However, you can choose your own pseudonym (an alternative fake name) so that you can recognise your comments in any reports.

What are the benefits of being involved?
Potentially lots! You will:

- further develop teamwork skills;
- meet new people;
- experience citizenship-in-action; and
- it could be a useful addition on your applications for when you leave school.

Also, your involvement could improve the way the University of Edinburgh interacts with young people. (And you may be able to go behind the scenes at the University, and food and drink will be provided during the group gatherings.)

What if you change your mind about being involved?
Not a problem: you will be able to stop your involvement at any point.

Where can you find out more? Just visit **ypagdunbar.wordpress.com** or you can contact me (Stuart Dunbar) either by:

- **email** s.dunbar@ed.ac.uk; or
- **phone** 0131 651 3597.

If you'd like to contact my supervisors, you can reach them at **john.davis@ed.ac.uk** and **eugenia.rodrigues@ed.ac.uk**.

How can you apply? Please return the application form on the next page (apologies again: it is quite formal!) as soon as possible, either by:

- **email** to s.dunbar@ed.ac.uk; or
- **post** to Stuart Dunbar, Engagement Manager, College of Science and Engineering, The University of Edinburgh, The King's Buildings, Weir Building, Max Born Crescent, Edinburgh, EH9 3BF.

Participants will be selected from the forms received. All applicants will be informed of the outcome.

[Thesis note: Form continues on next page]

Young SAGE application form


	Yes	No
I would like to become part of the Young SAGE group		

Please complete the following:

Name of **young person**:	Name of **responsible adult**:
Signature:	Signature:
Email:	Email:
Phone:	Phone:

If you agree with each statements below, please mark with an "X":

I agree for group gatherings to be voice-recorded	
I understand I can change my mind about my involvement in the group at any time	
I understand my real name will <u>not</u> be used in any reporting beyond the group	

The following details are requested to ensure (as much as possible) that the group involves a range of young people.

1. School attending (if attending one)			
2. Age		**3. Year group (2016/17; if applicable)**	

4. Gender (please mark with an X)

Female		Male		Prefer not to state my gender	

5. Ethnicity (please mark with an X)

Black British		Other Black		Asian British		Other Asian	
White British		Other British		Mixed background		Other background	
Prefer not to state my ethnicity							

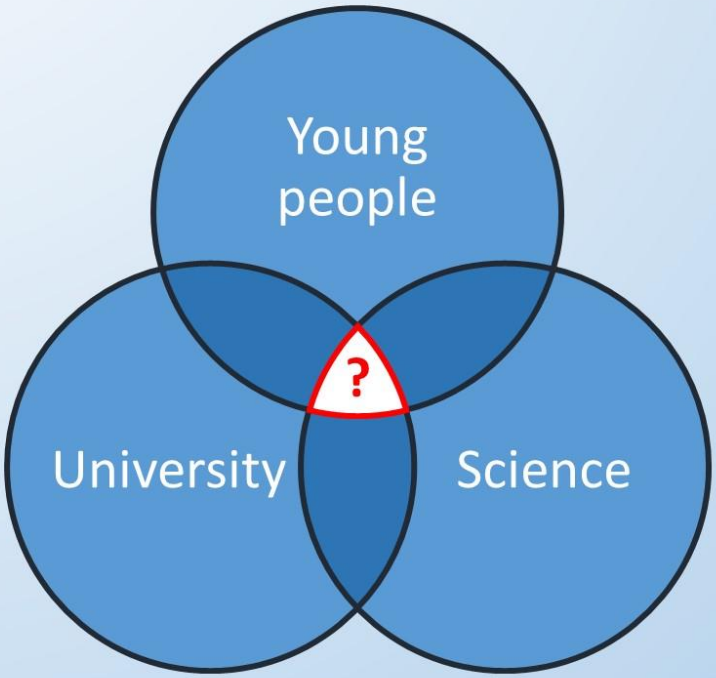
Appendix 3 – A3 colour poster for Young SAGE recruitment

Calling all S4-S6 pupils

THE UNIVERSITY of EDINBURGH

Are you interested in:

- being part of a new research project?
- meeting new people?
- sharing and discussing your ideas?
- helping the University of Edinburgh to help you?



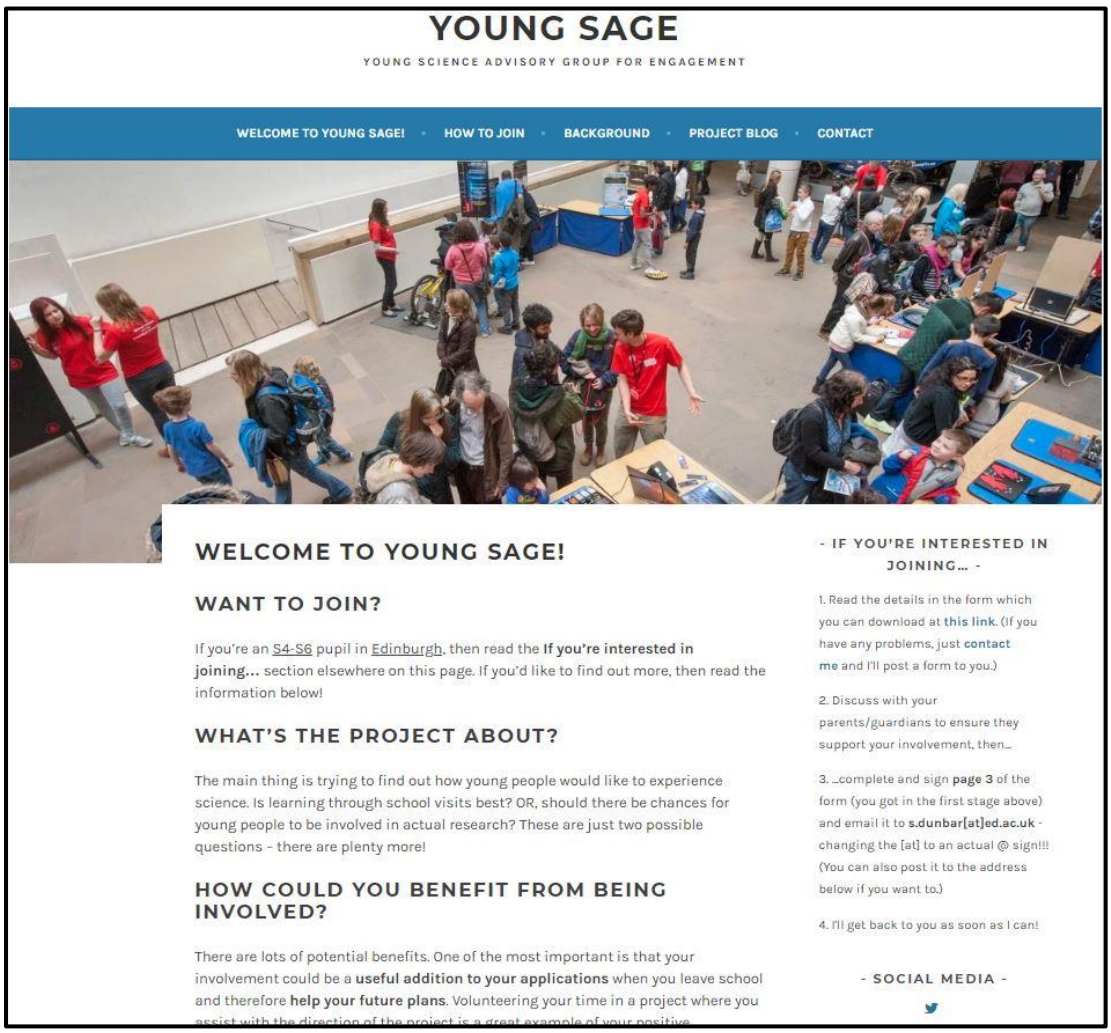
The University of Edinburgh is forming an advisory group of S4-S6 pupils as part of a unique research project. The core aim of this group will be to explore how science-based exercises should engage young people.

If you are interested in becoming involved, please contact Stuart Dunbar at s.dunbar@ed.ac.uk or call 0131 651 3597.

Alternatively, download the information form using the weblink below or the QR code on the right.

edin.ac/1S8YR0r

Appendix 4 – Young SAGE website homepage



YOUNG SAGE

YOUNG SCIENCE ADVISORY GROUP FOR ENGAGEMENT

WELCOME TO YOUNG SAGE! · HOW TO JOIN · BACKGROUND · PROJECT BLOG · CONTACT

WELCOME TO YOUNG SAGE!

WANT TO JOIN?

If you're an S4-S6 pupil in Edinburgh, then read the **If you're interested in joining...** section elsewhere on this page. If you'd like to find out more, then read the information below!

WHAT'S THE PROJECT ABOUT?

The main thing is trying to find out how young people would like to experience science. Is learning through school visits best? OR, should there be chances for young people to be involved in actual research? These are just two possible questions - there are plenty more!

HOW COULD YOU BENEFIT FROM BEING INVOLVED?

There are lots of potential benefits. One of the most important is that your involvement could be a **useful addition to your applications** when you leave school and therefore **help your future plans**. Volunteering your time in a project where you assist with the direction of the project is a great example of your positive

- IF YOU'RE INTERESTED IN JOINING... -

1. Read the details in the form which you can download at **this link**. (If you have any problems, just **contact me** and I'll post a form to you.)

2. Discuss with your parents/guardians to ensure they support your involvement, then...

3. ...complete and sign **page 3** of the form (you got in the first stage above) and email it to **s.dunbar[at]ed.ac.uk** - changing the [at] to an actual @ sign!!! (You can also post it to the address below if you want to.)

4. I'll get back to you as soon as I can!

- SOCIAL MEDIA -

Full website available at: https://ypagdunbar.wordpress.com/

Appendix 5 – Schedule for introductory interviews

[Thesis note: version from 9th Dec 2016 which moved questions to section 10 from earlier in the schedule, as well as including section 0.1 to offer participant a chance to talk freely earlier in the discussion.]

Opening		5-10 mins
0.	Introduce self. How are you? Thanks for time. Check ok with audio recording – just to ensure I don't miss something we talk about. Time expectation of around 30-45 mins for interview.	
0.1.	Could you tell me three things that you really like to do?	
1.	Introduction about project: my role at UoE – projects joining our scientists with other groups. Other events. Thinking about what young people want from their experiences of science – is there anything we're missing? Want to explore this idea collaboratively with young people and work together – your ideas vital. This is a part-time PhD project and have supervisors to guide and support me.	
1.1.	Regarding the background of the project, is there anything that you would like to know more about at this stage? [Open] (If nothing, then reassure participant can ask during the discussion or at any other time in the project! *Potentially linked to research question 5.*)	
Related to research question 4		2-5 mins
2.	About the project itself, what appeals to you about getting involved in the Young SAGE group? [Open]	
2.1.	What would you like to get from your involvement in the group? [Open]	
Related to research question 1		5-15 mins
3.	What sorts of science experiences have you had in the past couple of years? [Open] NOTE DOWN EXPERIENCES FOR REFERENCE IN LATER QUESTIONS If examples needed: science centre visits; work experience; science festivals; online videos; school visits to museums/labs/power station; career talks; experiments at home; science clubs; young engineers clubs	

3.1.	Can you take me through experience A [given by participant] with as much detail as you want to provide? [Open] Explorers/prompts: What did you do? Where was it? How did you get there? How did you do it? Did you have specific tasks to do and what were they? How were these set? Did you have to report to others? How did you prepare this report?	
3.2.	Thinking more about experience A [given by participant], what were the positives and/or the negatives about it? [Open] (May need to ask explicitly about the positive/negative again if partic overlooks this)	
Related to research question 2		5-10 mins
4.	Regarding how you became involved in these experiences: were you able to make a decision to get involved? [Closed]	
4.1a	If given a choice (to any): What helped with your decision? [Open] What was it about the experience that attracted you? [Open] Did you receive encouragement to get involved? [Closed] From who? [Limited]	
4.1b	If not given a choice (to any): Would you have liked to have been given the chance to choose to get involved in any of these experiences? [Closed] If yes: How would you have liked to have made your choice? [Open] (e.g.s if required: signed form / verbally / through guardians, more?) How would this have affected the experience you had? [Open]	
5.	How about during the experiences – in any of them, were you given the chance to make any choices? [Closed] If examples required: what tasks to complete in work experience, which parts of science museum to visit, which experiments would be completed first, which classmates/others you were grouped with.	

5.1	If yes (to any): What choices were you allowed to make? [Open] In what ways does having a choice affect the experience? [Open] *Probe for positives or negatives.*	
6	If no (to all 5 and 6): Would having the opportunity to choose have affected any of the experiences? [Closed] *(use examples from 6 above to aid initial thoughts on these – try to wait until participant says 'no' first and/or use to explore further thoughts after a 'yes' response.)*	
6.1.	If so, how would this have changed the experience? [Open]	
Related to research question 1 (again)		1-5 mins
7.	Are there any science experiences that you would like but not yet had the chance?	
7.1.	*[If time]* What has prevented you from having this/these experience(s) so far?	
7.2.	*[If time]* What would you like to get out of this/these experience(s)?	
Related to research question 4 (again)		1-5 mins
8.	Returning to the Young SAGE project itself again: as the project is focused on exploring young people's preferences of science experiences, do you have any ideas for what the Young SAGE group can do to meet this aim? [Open] If examples required: observe lab visits / school visits / citizen juries; attend lab visit / school project / citizen jury; explore (online) citizen science projects; attend different EISF events (drop-in, talk, expert panel, art-sci); design own activity/project/event; interview people who develop science experiences (e.g. CET / PEAG / Cit Sci); interview attendees of EISF or other events; survey of attendees…	
Practicality – related to ethics – some relation to research question 4 (again)		5 mins
9.	In terms of getting to and from the gatherings, how do you plan to travel? [Limited]	
9.1.	Would you mind if I contact your responsible adult about the gatherings to see if they require anything from me?	

	(For example, maybe they would like me to let them know when the gatherings are over.) [Closed/limited]	
10.	Just want to explore a few practicalities at first. For the group gathering, what sorts of places would you like us to meet? (Can give specifics if you wish!) [Limited] If examples needed: King's Buildings room / café; University room in town (e.g. Informatics Forum, café in Uni building); rotate around schools; youth club-related venues; city centre café; others YP suggest…	
10.1.	How long do you think the gatherings should be? [Limited]	
10.2.	Do you have any preferences for the food we should get for the gatherings? [Limited]	
10.3.	Ideally, until when do you think you could be involved with the group? [Limited]	
Conclusion		1-5 min
11.	I think that's everything for now. Would you like to ask about anything to do with the project? [Open]	
11.1.	Currently, aim for the first group gathering in mid-Dec or try in early Jan if that's tricky. (Try to avoid prelims time.) If you have any questions or ideas for what the group can do in the meantime, then just get in touch.	

Appendix 6 – Interview probes

Minimal

Active silence (with eye contact)

Hm hmm

Echoing or mirroring (e.g. last word/s of interviewee)

Comment

Unfinished comment (e.g. starting the sentence)

Request (use **what / how** constructions)

Elaboration	Can you explain that?
	Could you say a little more about that?
	Can you just describe a little more about that?
	Could you elaborate on that for me?
	Could you tell me a little more about XXXX?
	What does that entail?
	Could you develop that (a little further)?
Specification	Tell me more about that…
	How did that come about?
	How do you do that?
Example	Can you give me an example?
Experience	How often has this experience happened?
	Would you say this happened a lot?
Opinion	What is your view?
	Is this always the case (do you think)? [avoids generalisations]
Contrast	What about the opposite? (Describe opposite if required.)
Feeling	How would that format/approach make you feel?
	What sort of feeling does this give you?
Reasoning	What's your thinking behind…?
	What about XX makes it interesting for you? (change adjective to match participant's comment)

Paraphrase / summarise reflection – It sounds like you are saying… is this right? [use minimally]

Misc – I don't understand unfortunately / I'm not sure what you mean – please tell me again.

Probing tactics – can combine these with the requests above: e.g. "That's very good, but could you explain a little more about that?"

Accommodate	Being neutral	Challenge	You told me something else earlier
Encourage	Positive – interesting/good	Naïvety	I don't know anything about XX…

Also, Devil's Advocate: "That's really interesting, but some people say that…"

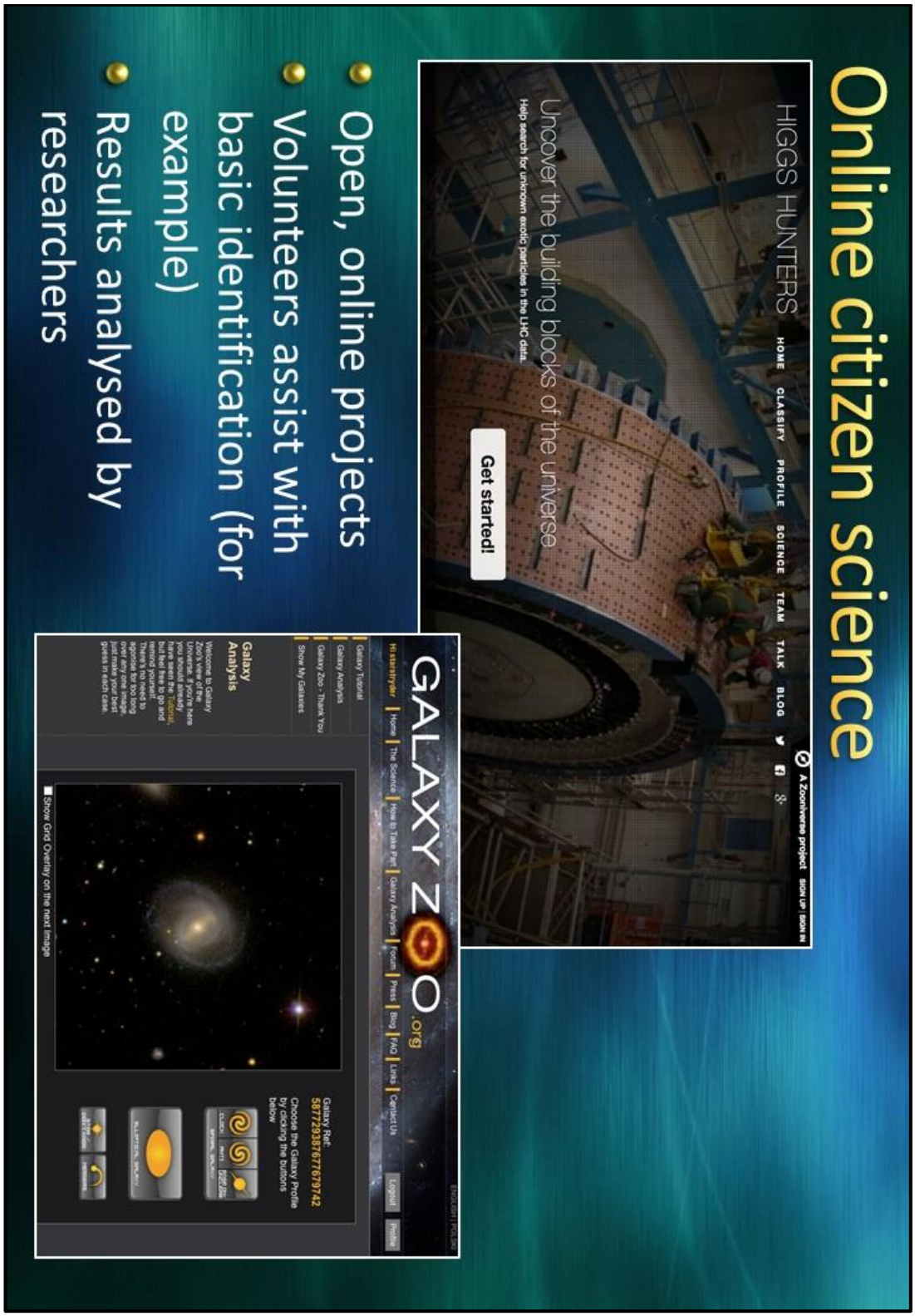
Returning to main topic

How does this relate to the idea of… (your experience of science)?

I'd like to understand more on how this… (was a positive/negative experience).

Appendix 7 – Example of science experience discussion card

[Thesis note: cards were printed at A4 size and laminated.]



Appendix 8 – Schedule for exit interviews

Thank you very much for agreeing to answer these questions. It is really useful to get your viewpoint of the project. The more perspectives I get, the greater the opportunity there is to improve the running of Young SAGE and similar projects in the future. Expect to last 45 mins.

		5-10 mins
0.	There are some things I know about you already, but could you remind me of: 1. your background (family, professions, nationalities); 2. your interests (hobbies); 3. your ambitions (long / short term – tuition fees influence for HE choice); 4. anything that makes you unique (e.g. certain abilities, languages, sports)	
0.1.	A technical point. I said at beginning I wouldn't use your name in any reporting. Is there a pseudonym that you would like me to use for you (just in case!)? (Can provide later in chat or after!)	
		2-15 mins
1.	In your view, what are the positives of the Young SAGE project?	
1.1.	And what are the negatives about the project?	
Other questions below may be covered by the responses to the questions above Need to adjust accordingly		
		1-5 mins
2.	If you had complete control of the project, how would you do things?	
2.1.	Can you explain the reasons for prioritising these steps?	
		1-5 mins
3.	Did the Young SAGE website (http://ypagdunbar.wordpress.com) give a suitable overview of the project?	

3.1.	Would you make any changes to the website? (If yes, could you describe any of these? How would these improve things?)	
		1-7 mins
4.	Do you have any comments to make about the application process?	
4.1.	Would you make any changes to the application process? (If yes, could you describe any of these?)	
4.2.	Would you change the application form in any way? If so, how?	
4.3.	How do you think it's best to get the information out to young people about this type of project?	
		1-5 mins
5.	Do you have any comments on how the gatherings were arranged? (i.e. like the Doodle polls, etc)	
5.1.	Would having fixed days – e.g. last Sunday every month – be better?	
		1-5 mins
6.	Do you have any thoughts (positive and negative) about the gatherings themselves?	
6.1.	What about the venues where the gatherings took place?	
6.2.	What are your views on how the discussions and tasks were carried out?	
		1-5 mins
7.	Thinking about my role, what are the priorities for someone in that role in order to make the project successful?	
7.1.	Again about my role, what actions can limit the success of the project?	

7.2.	How do you think I could improve if I do a similar project in the future?	
		1-5 mins
8.	Did your experience of the Young SAGE project meet your expectations? If so, how? If not, in what ways?	
8.1.	Have you benefited from your involvement in the project? In what ways?	
		1-7 mins
9.	Do you have any comments about the communications between our gatherings that took place?	
9.1.	What were the benefits / limitations? How could the limitations be overcome?	
9.2.	Do you have any specific comments about the Moodle platform?	
10.	**Individual questions?**	**5 mins**
		1-5 mins
11.	Do you have any general advice for projects which are looking to involve young people?	
12.	If there is anything else that you would like to comment on?	

Thank you very much for sharing your thoughts; I really appreciate your time.

Appendix 9 – Ethics application A (submitted: 17th June 2016)

University of Edinburgh

MORAY HOUSE SCHOOL OF EDUCATION ETHICS COMMITTEE

Student Application Form

(This form is for completion electronically)

PROCEDURE FOR ETHICAL APPROVAL

This form should be used for all research carried out by postgraduate students under the auspices of Moray House School of Education. A four-tier system of ethical approval has been developed, as explained in Section 2 on page 2.

This form should be completed by all Postgraduate students (taught or research degree) prior to research commencing. It should be completed in consultation with your main dissertation/thesis supervisor. The final version should be signed by the student and the supervisor and both should retain a copy. A revised form should be submitted if the nature of the research changes significantly during the period of study.

If the research is assessed at Level 0 or Level 1 the form need not be processed by the Moray House Ethics Committee. However a copy of the completed form should be sent to Shona Cunningham, Research Secretary at RKE Office (EMAIL REMOVED) for auditing purposes. If the research is considered to be at Level 2 or Level 3 (see Section 2) the application must be sent to Shona Cunningham who will arrange for it to be reviewed by the Moray House Ethics Committee.

(Please note that those students undertaking the Strength & Conditioning MSc and the MSc Performance Psychology should submit applications to the Programme Director of their course rather than the Ethics Committee).
Postgraduate research students should also submit a completed application form to their first year board.

Research should not commence until the supervisor(s) and, where necessary, the Ethics Committee have approved the ethics application.

SECTION 1: STUDENT & PROJECT DETAILS

1.1 Student name: Stuart Dunbar……..……

1.2 Programme: PhD Education (part-time)……..……

1.3 Supervisor(s): Prof John Davis……..……

Dr Eugénia Rodrigues……..……

1.4 Institute: Education, Community and Society (ECS)……..……

1.5 Title of Research Project: Exploring public engagement with science involving young people: a case study approach…….

1.6 Proposed research start date: June 2016……..……

1.7 Project duration: September 2019……..…

SECTION 2: ETHICS CATEGORY & GUIDANCE

2.1 Please tick the box which best describes your proposed research study:

Level 0: your research project is completely desk-based, i.e. does not involve participants. ☐

Level 1: covers research with participants that is 'non-problematic', i.e. the likelihood of physical or emotional risk to the participants is minimal. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal. X

Level 2: covers novel procedures, topics of a more sensitive nature, or the use of atypical participant groups – usually projects in which ethical issues might require more detailed consideration but are unlikely to prove problematic. ☐

Level 3: applies to research which is potentially problematic in that it may incorporate an inherent physical or emotional risk to participants. ☐

2.2 Ethical guidelines followed (tick all that apply):

British Educational Research Association (BERA)	☑
British Sociological Association (BSA)	☐
British Psychological Society (BPS)	☐
The British Association of Sport and Exercise Sciences (BASES)	☐
Other *(please write in)*	☐

2.3 Does the project require the approval of any other institution and/or ethics committee?

YES ☐ NO ☑

If YES, give details and indicate the status of the application at each other institution or ethics committee (i.e. submitted, approved, deferred, rejected).

SECTION 3: DESCRIPTION OF THE RESEARCH

Please provide a brief description (no more than 500 words) of your research. This should include, as appropriate, the aims and objectives of the study, the research question and/or hypothesis to be investigated, details of the sample, and data collection methods.

Aims/Objectives of Study

Within the field of Public Engagement with Science, research regarding views of different groups on engagement activities is a recent development, with children and young people still generally absent. My research aims to address this gap by establishing a young person advisory group for public engagement in the College of Science and Engineering at the University of Edinburgh, and exploring perspectives of young people through a case study research approach.

Research Questions

1. What are the diverse perspectives of young people with respect to public engagement with science exercises?
2. Resulting from the notions of either a pragmatic choice or indelible right to agency, what are the perspectives of adults and young people on informed choices being incorporated within public engagement with science exercises?
3. Under what circumstances are participatory public engagement with science exercises seeking the contributory expertise of young people possible and welcomed?
4. Within an adult-instigated participatory research project, in what ways do young people demonstrate their agency status and how might they re-mould and develop the project as it progresses?
5. In what ways do issues of power present themselves in an adult-instigated intergenerational project?
6. What are the merits and challenges of a young person advisory group for public engagement with science in a higher education institution?
7. In what ways can a young person advisory group influence a higher education institution's engagement of young people with scientific subjects?

Sampling

A self-selecting strategy will be used to recruit young people (14-17 years old: S4-S6) to the study. If there are insufficient numbers, a purposive approach will be employed by asking known teachers to provide nominations for introductory discussions. A statistically representative sample is not the aim of this case study research project.

Public engagement with science practitioners who become involved in the tasks of the advisory group will also be asked to participate in this project.

Data Collection Methods

Unstructured observations alongside audio recordings of advisory group meetings will be a central part of the data collection, combined with my own diary entries throughout the project. Advisory group members will be invited to keep their own written/audio/visual diaries. Semi-structured interviews with advisory group members

will be conducted at several stages throughout the study period; further interviews with public engagement with science practitioners will also be undertaken depending on the precise tasks of the advisory group.

If your project is 'Level 0' please go now to Section 8.

SECTION 4: PARTICIPANTS

4.1 How many participants do you intend to include in the research?

The intention will be for 8-10 young people to be recruited for the main part of the study. A selection of public engagement with science practitioners at the University of Edinburgh will also be interviewed.

4.2 What criteria will be used in deciding on the inclusion and exclusion of participants in the study?

To enable quality discussion and action, the advisory group would benefit from a diversity of participants. The key characteristics that will be prioritised are gender, ethnicity, and school attended (which will be recognised through the groupings utilised by the LEAPS programme). However, it is not intended to have pre-defined proportions of different genders and ethnicities within the advisory group. Please note: no person will be excluded from the research on the basis of an equity/diversity issue.

4.3 How will the sample be recruited?

Recruitment will initially entail sending posters/information through to local secondary schools at which I already have contacts through my work role, and the curriculum contact at the local council will also be approached to support recruitment efforts at further schools. If insufficient participants are secured, I will then ask known teachers for nominations and have preliminary discussions with these S4-S6 (14-17 year old) pupils to ascertain if they wish to be involved.

4.4 Will participants receive any financial or other material benefits because of participation? YES ☑ NO ☐

If YES, what benefits will be offered to participants and why?

Potentially. Access to different science-related events may become part of the advisory group requirements. Entry fees to specific events will be covered (if the group decides that attending events to enhance their perspectives will be appropriate). Particularly if the purposive sampling approach is required, then the young participants may consider it beneficial to add their involvement to their CVs. Lunch/snacks will be provided as part of the meetings.

4.5 Are any participants likely to experience difficulties in participating fully in the study? (e.g. due to age, knowledge of English language, physical ability, additional support needs etc). YES ☑ NO ☐

If YES, please outline the nature of this issue, and explain how participants will be supported to participate:

Given the nature of the advisory group, there is the possibility that those with language, communication or additional support needs may find the discussions challenging. If participants have any particular needs, I will explore and make any reasonable adjustments to enable their participation, e.g. translator for English as a foreign language issues; sign-interpreter for those with compromised hearing; etc.

SECTION 5: POTENTIAL RISKS TO PARTICIPANTS/RESEARCHER

5.1 Could the research induce any psychological stress or discomfort in the participants? YES ☑ NO □

If YES, state the nature of the risk and what measures will be taken to deal with such problems.

Psychological stress or discomfort is not the intention of this research project, but in any collaborative study there is the potential for disagreements to lead to adverse effects on participants. To minimise the risk, discussion parameters will be set at the start, including the agreement on the ground rules for the in-person discussions as well as for the communication platforms agreed with participants for contact between meetings (e.g. parental/young people contact details, email, online forum, etc.). (I am in contact with Claire Houghton, CRFR, regarding issues of this nature based on her experiences of working with a young person expert group.) The group discussions will include the notions of respect for the views of others, as well as not using shared information to harm/injure others outside of the advisory group context.

In the event of any particular concerns from participants, opportunities for individuals to discuss these with me will be available after the meetings if required. Information regarding relevant local support groups will be on hand and shared if necessary.

5.2 Does the research require any physically invasive or potentially physically harmful procedures?YES □ NO ☑

If YES, give details and outline procedures to be put in place to deal with potential problems.

N/A

5.3 Does the research involve the investigation of any illegal behaviours?
YES □ NO ☑

If YES, give details.

N/A

5.4 Is it possible that this research will lead to the disclosure of information about child abuse or neglect?

YES ☑ NO ☐

If YES, indicate the likelihood of such disclosure and your proposed response to this. If there is a real risk of such disclosure triggering an obligation to make a report to Police, Social Work or other authorities, a warning to this effect must be included in the Information and Consent documents.

The subject matter is unlikely to lead to disclosures, but it is always a possibility in any research with children and young people. If potential child protection issues are raised, I will contact Social Care Direct[41] or a relevant children's charity. The fact that I may need to pass on disclosures will be included in the information given to all participants during the first advisory group meeting. My past experience as a primary school teacher, and ongoing experience in working in secondary schools with the SCI-FUN Roadshow, means I am sensitive to the potential of disclosures.

5.5 Is there any purpose to which the research findings could be put that could adversely affect participants?

YES ☐ NO ☑

If YES, describe the potential risk for participants of this use of the data. Outline any steps that will be taken to protect participants.

N/A

5.6 Could this research adversely affect participants in any other way? YES ☐ NO ☑

If YES, give details and outline procedures to be put in place to deal with such problems.

N/A

5.7 Could this research adversely affect members of particular groups of people?

YES ☑ NO ☐

If YES, describe these possible adverse effects and the protection to be put in place against them.

There is a minor chance that anyone who offers to participate but is not selected will feel rejected by the outcome. If any declinations of potential participants are necessary, the offer will be made to discuss the reasoning behind this and to ensure that the young person is aware that their non-participation is not to do with any limitation in abilities or characteristics of the individual. If the person is still interested in participation, then details of local organisations linking to opportunities will be provided, such as Young Scot[42].

[41] http://www.edinburgh.gov.uk/info/20046/protect_someone_from_harm/365/child_protection
[42] http://young.scot/things-to-do/

5.8 Is this research expected to benefit the participants, directly or indirectly?

YES ☑ NO ☐

If YES, give details.

It is hoped that the possibility of contributing will help in the further development of social skills and teamwork and provide a practical experience of citizenship. Beyond this, more tangible benefits (University lab visits for example) will be discussed with participants. Young participants may use their involvement in the advisory group as part of post-school applications (e.g. University).

5.9 Will the true purpose of the research be concealed from the participants?

YES ☐ NO ☑

If YES, explain what information will be concealed and why. Will participants be debriefed at the conclusion of the study? If not, why not?

N/A

5.10 At any stage in this research could researchers' safety be compromised or could the research induce emotional distress in the researchers?

YES ☑ NO ☐

If YES, to either or both, give details and outline procedures to be out in place to deal with potential problems.

It is unlikely that researcher safety is going to be compromised, and although there is a chance that distress could happen, it is not expected and the risk is low. I will maintain regular contact with my supervisors, and post-advisory group meeting discussions/analysis will be undertaken. On a practical level, for any communication channels agreed with participants during the study, I will use study-specific profiles as required (e.g. specific mobile number; specific forum profile; etc.). Only work-related media will be employed to contact or communicate with the young participants. None of the communication channels will involve my own personal contact details/sites. As stated previously, due to my experience as a primary school teacher, I have had child protection training and am aware of how to appropriately work with groups of children and young people.

Before completing Sections 6 - 8 please refer to the University Data Protection Policy to ensure that the relevant requirements relating to the processing and retention of personal data have been met. It is also advised that applicants

familiarise themselves with the: "Researcher checklist for compliance with the Data Protection Act" See:
http://www.recordsmanagement.ed.ac.uk/InfoStaff/DPstaff/DPResearch/ResearchAndDPA.htm
(Now here: http://www.ed.ac.uk/records-management-section/data-protection/guidance-policies/research-and-the-data-protection-act/research - accessed 14th Feb 2016)

SECTION 6: PARTICIPANT INFORMATION AND CONSENT

6.1 Will written consent be obtained from all participants? YES ☑ NO ☐

If YES, attach a copy of the information sheet(s) and consent forms (covering project details, confidentiality, freedom to withdraw at any stage of the project).

If NO, please explain why not below:

Please note with regards to consent:
- It would normally be expected that child and parental consent be sought where participants are aged under 18
- If consent cannot or should not be sought for some reason, a clear case and rationale for this must be made below

Sheets and forms attached.

Administrative consent may be deemed sufficient:

a) for studies where the data collection involves aggregated (not individual) statistical information and where the collection of data presents:

(i) no invasion of privacy;
(ii) no potential social or emotional risks:

b) for studies which focus on the development and evaluation of curriculum materials, resources, guidelines, test items, or programme evaluations rather than the study, observation, and evaluation of individuals.

6.2 Will administrative consent (e.g. from a headteacher) be obtained in lieu of participants' consent? YES ☐ NO ☑

If YES, explain why individual consent is not considered necessary.

N/A

6.3 Might any potential participants find it difficult to provide/withhold ongoing informed consent? (e.g. due to age, knowledge of English language, additional support needs, student/professional/dependent relationship with the researcher etc).

YES ☑ NO ☐

If YES, please outline the nature of this issue, and explain how participants will be supported during the ongoing consent process:

For participants who have language difficulties or additional support needs, reasonable adjustments will be made to enable their full participation (e.g. translator, interpreter, etc.), which will also assist in enabling ongoing informed consent. All participants will be informed they can withdraw at any point.

If NO, give reasons.

SECTION 7: RESEARCH INVOLVING CHILDREN/VULNERABLE ADULTS
Complete this section only if your research involves minors, (i.e. individuals who are less than 18 years) or vulnerable adults.

7.1 All researchers who plan to work directly with children and vulnerable adults should obtain application forms from the Protecting Vulnerable Groups Scheme (PVG Scheme) See http://www.disclosurescotland.co.uk/apply/

Have you obtained the necessary, up to date Disclosure Scotland Clearance?

YES ☑ NO ☐ AWAITING CLEARANCE ☐

7.2 In the case of minors participating in the research on an individual basis, will the consent or assent of parents be obtained? YES ☑ NO ☐

If YES, explain how this consent or assent will be obtained.

If NO, give reasons.

Consent will be secured through the information/application form. Not only will the young person have to sign the application form, but a responsible adult will need to sign also. Contact details for both the young applicant and their responsible adult will be requested so that consent can be confirmed with the responsible adult.

7.3 Will the consent or assent (at least verbal) of minors participating in the research on an individual basis be obtained?

YES ☑ NO ☐

If YES, explain how this consent or assent will be obtained.

If NO, give reasons.

Consent of young participants will be sought through the same information/application form as described in 7.2 above. This will be reaffirmed during the first advisory group meeting. Ongoing consent will be indicated by future participation in the group meetings.

SECTION 8: CONFIDENTIALITY AND HANDLING OF DATA

8.1 Will the research require the collection of personal information from e.g. universities, schools, employers, or other agencies about individuals without their direct consent?

YES ☐ NO ☑

If YES, state what information will be sought and why written consent for access to this information will not be obtained from the participants themselves.

8.2 Will any part of the research involving participants be audio/film/video taped or recorded using any other electronic medium?

YES ☑ NO ☐

If YES, what medium is to be used and how will the recordings be used?

Audio recordings will be made of the advisory group meetings and at least key parts of the meetings will be transcribed. Semi-structured interviews throughout the study will also be audio-recorded and transcribed. These will form elements of the data collection upon which the analysis will be undertaken. The recordings will be saved on my University drive space, as well as a non-networked physical drive.

8.3 Who will have access to the raw data from the research (record forms, documents, electronic media etc.)?

I will have access and access will be provided to my supervisors as necessary/required. Outcomes for public engagement with science at the University of Edinburgh will rely on my reporting (or advisory group members' direct reporting) to practitioners rather than the raw recordings of meetings and interviews.

8.4 How will the confidentiality of data, including the identity of participants, be ensured?

Electronic data will be saved on my dedicated space on the University's network, as well as on a physical drive at another secure location. I have been advised that full encryption of my study data is not necessary, as long as personal details of participants are not stored in the same location as any data collection files. Application and consent forms will be kept in a lockable location away from the physical drive.

8.5 Specify where/by whom the datafiles/audio/video tapes, etc. will be retained after the completion of the period of study, how long they will be retained and how they will eventually be disposed of.

See 8.4. Once the award of the PhD has been made, the electronic and physical data will be disposed of. The physical drive will be re-formatted to remove the data completely.

8.6 How do you intend for the results of the research to be used?

The outcomes of the research will be presented in a case study format: conclusions will be outlined for the specific case which should offer insights that will be useful for other public engagement practitioners, who will be invited to decide on how appropriate the conclusions are for their own contexts.

8.7 Will feedback of findings be given to participants? YES ☑ NO ☐

If YES, how and when will this feedback be provided?

A verbal overview will be given to participants during the advisory group meetings following the formal study period. A summary of key outcomes will also be produced for participants, highlighting how their involvement has contributed to the achievements of the group.

8.8 Does your research concern groups which may be construed as terrorist or extremist? YES ☐ NO ☑

If YES please contact Shona Cunningham (EMAIL REMOVED) to be sent a supplementary form you will need to complete

8.9 Will your research involve accessing material that could be viewed as promoting terrorism or extremism? YES ☐ NO ☑

If YES please contact Shona Cunningham (EMAIL REMOVED) to be sent a supplementary form you will need to complete

SECTION 9: CONFLICT OF INTEREST

The University has a 'Policy on the Conflict of Interest' (see: http://www.docs.csg.ed.ac.uk/HumanResources/Policy/Conflict_of_Interest.pdf now at http://www.ed.ac.uk/polopoly_fs/1.161876!/fileManager/Conflict_of_Interest.pdf [accessed 14th Feb 2016])

An example of a conflict of interest is given as follows:

"compromising research objectivity or independence in return for financial or non-financial benefit for him/herself or for a relative or friend." (Policy on Conflict of Interest, University of Edinburgh, p. 3)

The policy also states that the responsibility for avoiding a conflict of interest, in the first instance, lies with the individual, but that potential conflicts of interest should

always be disclosed, normally to the student supervisor, line manager or Head of Institute. Failure to disclose a conflict of interest or to cease involvement until the conflict has been resolved may result in disciplinary action.

9.1 Does your research involve a conflict of interest as outlined above? YES ☐NO ☑

If YES, give details.

N/A

SECTION 10: SIGNATURES

Student signature:……..... **Date:** ……..…

Supervisor signature:……..... **Date:** ……..…

N.B. Have you attached copies of participant information sheet(s) and consent sheet(s) if appropriate? Have you checked through your application to ensure that you have answered all relevant questions?

Please note <u>all</u> completed forms should be sent to Shona Cunningham, Research Secretary, RKE Office, Moray House School of Education (EMAIL REMOVED)

Appendix 10 – Ethics application B (submitted: 30th July 2017)

THE UNIVERSITY of EDINBURGH
Moray House School of Education

Research and Knowledge Exchange
Ethics Committee

Student Application Form V2

PROCEDURE FOR ETHICAL APPROVAL

This form must be completed electronically by all Postgraduate students (taught or research degree) prior to research commencing.

PhD/EdD Student

All Levels: Applications must be authorised by your supervisor and submitted to the Ethics Committee. The Ethics Committee will review your application and provide feedback and authorisation.

Research should not commence until the supervisor(s) and, where necessary, the Ethics Committee have approved the ethics application.

Level 1: Your research project is completely desk-based (i.e. does not involve participants) and does not use information about living, identifiable individuals ('data subjects').

Level 2: Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

Level 3: Applies to novel procedures, research without consent, sensitive personal data, or the use of atypical participant groups. Also projects in which ethical issues might require more detailed consideration but are unlikely to prove problematic.

Level 4: Applies to research which is potentially problematic in that it may incorporate an inherent physical or emotional risk to researchers or participants; involve covert surveillance or covert data collection; or includes research studies in the NHS involving humans, their tissue and/or data.

SECTION 1: STUDENT & PROJECT DETAILS

1.1 Student Name: Stuart Dunbar

1.2 Programme: PhD

1.3 Supervisor(s): John Davis

1.4 Institute: ECS

1.5 Title of Research Project: Exploring public engagement with science involving young people: a case study approach

1.6 Proposed research start date: Aug 2017

1.7 Project Duration: Jan 2018

SECTION 2: ETHICS CATEGORY & GUIDANCE

2.1 Please tick the box which best describes your proposed research study:

◉ **Level 2:** Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

2.2 Ethical giudelines followed (tick all that apply)

☑ British Educational Research Association (BERA)

2.3 Does the project require the approval of any other institution and/or ethics committee? NO

SECTION 3: DESCRIPTION OF THE RESEARCH

To clarify: this application recognises the evolution of my collaborative project involving a group of local young people (16-18 years old) and has been developed with these participants. I already received ethical clearance for the overall project in June 2016.

Aims/Objectives of Study

Within the field of Public Engagement with Science, research regarding views of different groups on engagement activities is a recent development, with children and young people still generally absent. The current project aims to address this gap through establishing and collaborating with Young SAGE: a young person advisory group for public engagement in the College of Science and Engineering at the University of Edinburgh. Initial discussions with the Young SAGE participants has led to an outline research plan (see below). This ethics application has been developed alongside three of the group members and shared with the rest of the group.

Research question – developed in the initial phase of Young SAGE

“Can interactive science experiences change young students’ interest in science?”

Outline research plan

1. A survey of 16-18 year olds based on exploring the science experiences they would have liked at primary / secondary school level. Complete by mid-Sept. This stage of the project is the subject of this current application - a further application will be made to cover stages 2-5 after further planning.

2. A survey of 11-14 year olds attending stage 3 (below) to gauge current interest in science and their science experiences to date. Complete by end of October.

3. An event for 11-14 year olds informed by the survey for 16-18 year olds. Science experiences to be potentially provided by University staff and other local relevant institutions. Undertaken in early/mid-November.

4. Brief group discussions / focus groups with event attendees immediately after the event. Early/mid-November.

5. A follow-up survey of 11-14 year olds involving similar questions to stage 2. Complete end-November / early-December.

Surveys developed by the young people in the Young SAGE group will be set-up using Google Forms for participants to complete online.

Sampling

Convenience samples: All stages of the research plan are intended to involve the schools of the Young SAGE participants themselves. It will be made clear that all pupils can opt-out of responding to the surveys.

November events – elements that need confirmation

• Will need to be a large venue, potentially at the University, capable of accommodating 200+ pupils plus staff and science experiences.

• Will need science experiences from University and other local institutions.

• May need to explore payments to staff for their involvement – considered unlikely – or visit fees for other projects – which is possible.

• Will need to explore if transport fees will need to be covered for attending schools and how to meet these.

SECTION 4: PARTICIPANTS

4.1 How many participants is it hoped to include in the research?: 2000 appro

4.2 What criteria will be used in deciding on the inclusion and exclusion of participants in the study?

Pupils from the 5 schools which the Young SAGE participants attend will be invited to participate at each stage: 16-18 year olds for stage 1 (initial survey - up to 1000 respondents) and 11-14 year olds for stages 2-5 (potentially 1000 participants).

4.3 How will the sample be recruited?

Recruitment will be through the Young SAGE participants in communication with teaching staff at their schools.

4.4 Will participants receive any financial or other material benefits because of participation? NO

4.5 Are any participants likely to experience difficulties in participating fully in the study? (e.g. due to age, knowledge of English language, physical ability, additional support needs etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported to participate.

Participants may experience difficulties with the surveys due to language ability and potential additional support needs. It is anticipated that, as these surveys will be available online and engagement encouraged through schools, that these individuals should have the support to participate as they would with any other part of their education.

Physical abilities and additional support needs may impair the accessibility of some of the science experiences in the November events, but again we anticipate that support will be available in line with the individuals' general education.

SECTION 5: POTENTIAL RISKS TO PARTICIPANTS/RESEARCHER

5.1 Could the research induce any psychological stress or discomfort in the particpants? YES

If YES, state the nature of the risk and what measures will be taken to deal with such problems.

Although we have indicated yes, we anticipate this is extremely unlikely. For example, at its worst, an individual may have a phobia of an element in an experience in the November events. We do not intend for all event attendees to have every available experience, so those with phobias could opt-out of specific experiences. The group discussions after the events have a small chance of causing disagreements between individuals, but the nature of the discussion should mean that differences of opinions will not lead to extreme reactions.

5.2 Does the research require any physically invasive or potentially physically harmful procedures YES

If YES, give details and outline procedures to be put in place to deal with potential problems.

Although we believe this is highly unlikely. The surveys and group discussion will not cause any issues. The science experiences in the November events will be risk-assessed, so there is an extremely minimal chance of physically harmful procedures.

5.3 Does the research involve the investigation of any illegal behaviours? NO

5.4 Is it possible that this research will lead to the disclosure of information about child abuse or neglect? YES

If YES, indicate the likelihood of such disclosure and your proposed response to this. If there is a real risk of such disclosure triggering an obligation to make a report to Police, Social Work or other authorities, a warning to this effect must be included in the Information and Consent documents.

Although we have indicated yes, we believe the chance of disclosures is extremely unlikely due to the nature of the subject matter, but it is always a possibility in any research with young people. The group discussions will be led by the Young SAGE participants, but I will be available to provide advice on disclosures if necessary. My past experience as a primary school teacher, and ongoing experience in working in secondary schools with the SCI-FUN Roadshow, means I am sensitive to the potential of disclosures. Any issues will be shared with the school staff accompanying the event attendees.

5.5 Is there any purpose to which the research findings could be put that could adversely affect participants? YES

If YES, describe the potential risk for participants of this use of the data. Outline any steps that will be taken to protect participants.

Another extremely unlikely possibility. Survey responses will be anonymous, so there is minimal chance, and the subject matter makes any adverse effects incredibly unlikely.

5.6 Could this research adversely affect participants in any other way? YES

If YES, give details and outline procedures to be put in place to deal with such problems.

Another extremely unlikely possibility for the surveys and group discussions. In our view, we cannot envisage any issues, but we don't know the precise circumstances of all participants / event attendees.

Some of the science experiences in the November events could present hazards, but risk assessments will minimise these and experiences and are likely to be accompanied by a 'presenter'. Event attendees can also opt-in/out of different experiences.

5.7 Could this research adversely affect members of particular groups of people? YES

If YES, describe these possible adverse effects and the protection to be put in place against them.

Extremely unlikely, but religious beliefs could oppose some of the material within the November events science experiences. Event attendees can choose not to engage with such experiences.

5.8 Is this research expected to benefit the participants, directly or indirectly? YES

If YES, give details.

The science experiences will hopefully be positive and fun! Depending on the nature of the activities, the experiences may also assist with the subject choice process that the event attendees will shortly be going through. What is learnt from the project could/should lead to improved science experiences in the future.

5.9 Will the true purpose of the research be concealed from the participants? NO

5.10 At any stage in this research could researchers' safety be compromised or could the research induce emotional distress in the researchers? YES

If YES, to either or both, give details and outline procedures to be out in place to deal with potential problems.

This is incredibly unlikely but cannot be totally discounted. Within the group discussions after the November sessions, some comments may take the research team – myself and the rest of the Young SAGE participants – by surprise (such as disclosures of sensitive matters). The group discussions are likely to involve two of the Young SAGE participants and I will be present in the room. Any serious matters will be reported to teaching staff who are present, and I will discuss any longer-term issues with my supervisors as required.

SECTION 6: PARTICIPANT INFORMATION AND CONSENT

6.1 Will written consent be obtained from participants? YES

Attachments: (NB you can upload multiple files at the same time)

2 files: (click to download)

docx.jpg Example-survey-16-18-20170727.docx

docx.jpg Content of Secondary School STEM Survey-20170904.docx

Administrative consent may be deemed sufficient:

a. for studies where the data collection involves aggregated (not individual) statistical information and where the collection of data presents:

   i. no invasion of privacy;
   ii. no potential social or emotional risks:

b. for studies which focus on the development and evaluation of curriculum materials, resources, guidelines, test items, or programme evaluations rather than the study, observation, and evaluation of individuals.

6.2 Will administrative consent (eg. from a headteacher) be obtained in lieu of participants' consent? YES

If YES, explain why individual consent is not considered necessary.

For the surveys, as they are intended to be completed within school time, the initial consent to ask the different samples to respond will be sought from teachers in the relevant schools. It will then be made clear at the start of the survey what the purpose of the survey is, and it will also be clear that pupils do not need to participate if they do not wish to.

For the November events, schools will require parental consent to bring the pupils to the venue. If pupils wish to opt-out of the different science experiences, then they may do.

6.3 Might any potential participants find it difficult to provide/withhold ongoing informed consent? (e.g. due to age, knowledge of English language, additional support needs, student/professional/dependent relationship with the researcher etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported during the ongoing consent process. If NO, give reasons.

For the surveys, as previously stated, it is expected that those with English language and additional support needs will have the support required to engage with the surveys as appropriate, since the expectation is that these will be completed within school time.

However, being completed within school time can also make it unclear that participation is voluntary. To assist with this issue, a written statement will be made at the start of the surveys to reinforce the message that pupils can choose not to respond.

SECTION 7: RESEARCH INVOLVING CHILDREN/VULNERABLE ADULTS

Complete this section only if your research involves minors, (ie individuals who are less than 18 years) or vulnerable adults.

7.1 All researchers who plan to work directly with children and vulnerable adults should obtain application forms from the Protecting Vulnerable Groups Scheme (PVG Scheme) See http://www.disclosurescotland.co.uk/apply/

Have you obtained the necessary, up to date Disclosure Scotland Clearance? YES

7.2 In the case of minors participating in the research on an individual basis, will the consent or assent of parents be obtained? YES

If YES, explain how this consent or assent will be obtained. If NO, give reasons.

Only for the November events, parental consent will be required to take the pupils out of school. For the other elements of the project, then teachers from the schools will be asked for consent to ask their pupils to participate in the different project stages.

(Also, with regards to section 7.1, due to the nature of the group interviews (two 16-18 year old participants with a group of approximately eight 11-14 year olds), PVG clearance for the Young SAGE members is not required. This has been discussed via email with Jane Brown. (My PVG status has already been secured from the outset of this project.)

7.3 Will the consent or assent (at least verbal) of minors participating in the research on an individual basis be obtained? YES

If YES, what arrangements will be made? If NO, give reasons.

For the surveys, a statement at the start will reinforce the message that participation is voluntary and pupils can opt-in/opt-out as they wish. For the group discussions after the November events, pupils will be invited to take part.

SECTION 8: CONFIDENTIALITY AND HANDLING OF DATA

8.1 Will the research require the collection of personal information frome.g. universities, schools, employers, or other agencies about individuals without their direct consent? NO

8.2 Will any part of the research involving participants be audio/film/video taped or recorded using any other electronic medium? YES

If YES, what medium is to be used and how will the recordings be used?

Audio recordings of the group discussions (stage 4) will be made to aid recall of the discussion and improve note-taking.

8.3 Who will have access to the raw data?

The Young SAGE group (including myself), as well as my supervisors.

8.4 How will the confidentiality of data, including the identity of participants, be ensured?

Raw data will not be shared beyond the people indicated in 8.3. No names will be requested for the surveys. Any details taken from the group discussions will be anonymised.

Survey data will be downloaded from Google Forms and sorted using Excel.

8.5 Specify where the datafiles/audio/video tapes, etc. will be retained after the study, how long they will be retained and how they will eventually be disposed of.

Once the award of the PhD has been made, the electronic and physical data will be disposed of. Any data on physical drives will be re-formatted to remove the data completely.

During the project, golden copies of the survey and audio data will be stored on my student data-storage area (and therefore automatically backed-up). For working with these data in the Young SAGE group, there will be some temporary storage on individual machines/laptops, but these data will be deleted as soon as it is practical. No data will remain on a machine/laptop after a Young SAGE group gathering - there will only be the central golden copy on my student data storage area. (Even if an individual machine is hacked at a later date and the hacker can recombine the deleted data fragments that could remain on a machine, none of the data can be attributed to an individual, so confidentiality will not be compromised.)

8.6 How do you intend for the results of the research to be used?

The outcomes of this project will be shared with providers of science experiences to improve what is developed for young people. Initially, this will be mainly colleagues in the University, but there could/should be possibilities of sharing the outcomes of this project more widely.

The research data will also contribute to my PhD project.

8.7 Will feedback of findings be given to participants? YES

If YES, how and when will this feedback be provided?

Findings will be shared with schools for onward sharing with their pupils, and potentially presentations during assemblies. The precise process is still under discussion.

8.8 Does your research concern groups which may be construed as terrorist or extremist? NO

8.9 Will your research involve accessing material that could be viewed as promoting terrorism or extremism? NO

SECTION 9: CONFLICT OF INTEREST

The University has a draft 'Policy on the Conflict of Interest' (copies available from the Research Support Office). Regarding research the draft states that a conflict of interest would arise in cases where an employee of the University might be

> **"compromising research objectivity or independence in return for financial or non-financial benefit for him/herself or for a relative or friend."**

The draft policy also states that the responsibility for avoiding a conflict of interest, in the first instance, lies with the individual, but that potential conflicts of interest should always be disclosed, normally to the line manager or Head of Department. Failure to disclose a conflict of interest or to cease involvement until the conflict has been resolved may result in disciplinary action and in serious cases could result in dismissal.

9.1 Does your research involve a conflict of interest as outlined above? NO

SECTION 10: SIGNATURES

Students Signature: Stuart Dunbar Date: 30/07/17

Supervisor Signature: john davis Date: 17/08/2017

N.B. Have you attached copies of participant information sheet(s) and consent sheet(s) if appropriate? Have you checked through your application to ensure that you have answered all relevant questions?

Application Form ID=703

Appendix 11 – Ethics application C (submitted: 6th November 2017)

THE UNIVERSITY of EDINBURGH
Moray House School of Education

Research and Knowledge Exchange
Ethics Committee

Student Application Form V2

PROCEDURE FOR ETHICAL APPROVAL

This form must be completed electronically by all Postgraduate students (taught or research degree) prior to research commencing.

PhD/EdD Student

All Levels: Applications must be authorised by your supervisor and submitted to the Ethics Committee. The Ethics Committee will review your application and provide feedback and authorisation.

Research should not commence until the supervisor(s) and, where necessary, the Ethics Committee have approved the ethics application.

Level 1: Your research project is completely desk-based (i.e. does not involve participants) and does not use information about living, identifiable individuals ('data subjects').

Level 2: Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

Level 3: Applies to novel procedures, research without consent, sensitive personal data, or the use of atypical participant groups. Also projects in which ethical issues might require more detailed consideration but are unlikely to prove problematic.

Level 4: Applies to research which is potentially problematic in that it may incorporate an inherent physical or emotional risk to researchers or participants; involve covert surveillance or covert data collection; or includes research studies in the NHS involving humans, their tissue and/or data.

SECTION 1: STUDENT & PROJECT DETAILS

1.1 Student Name: Stuart Dunbar

1.2 Programme: PhD

1.3 Supervisor(s): John Davis

1.4 Institute: ECS

1.5 Title of Research Project: Exploring public engagement with science involving young people: a case study approach

1.6 Proposed research start date: 13/11/2017

1.7 Project Duration: 08/12/17

SECTION 2: ETHICS CATEGORY & GUIDANCE

2.1 Please tick the box which best describes your proposed research study:

◉ **Level 2:** Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

2.2 Ethical giudelines followed (tick all that apply)

☑ British Educational Research Association (BERA)

2.3 Does the project require the approval of any other institution and/or ethics committee? NO

SECTION 3: DESCRIPTION OF THE RESEARCH

To clarify: this application recognises the further evolution of my collaborative project involving a group of local young people (16-18 years old) and has been developed with these participants in a project called Young SAGE. I already received ethical clearance for the overall project in June 2016, as well as an initial survey (stage 1 of the plan below) in Sept 2017. The present application covers stage 2 of the research plan below. Timelines have been updated since the previous ethics application (which has an approval reference number of 1164).

Aims/Objectives of Study

Within the field of Public Engagement with Science, research regarding views of different groups on engagement activities is a recent development, with children and young people still generally absent. The current project aims to address this gap through establishing and collaborating with Young SAGE: a young person advisory group for public engagement in the College of Science and Engineering at the University of Edinburgh. Initial discussions with the Young SAGE participants has led to an outline research plan (see below).

Research question – developed in the initial phase of Young SAGE

“Can interactive science experiences change young students’ interest in science?”

Outline research plan

1. A survey of 16-18 year olds based on exploring the science experiences they would have liked at primary / secondary school level. Completed late-Sept.

2. A survey of S1/S2 pupils (11-14 year olds) attending stage 3 (below) to gauge current interest in science and their science experiences to date. It will also inform the development of the event in stage 3 (hence a separate application will be made for stages 3-5). Complete by mid-Dec. This stage of the project is the subject of this current application - a further application will be made to cover stages 3-5 after further planning.

3. An event for 11-14 year olds informed by the survey for 16-18 year olds. Science experiences to be potentially provided by University staff and other local relevant institutions. Undertaken in late-Feb 2018.

4. Brief group discussions / focus groups with event attendees immediately after the event. Late-Feb 2018.

5. A follow-up survey of S1/S2 pupils involving similar questions to stage 2. Complete early Mar 2018.

For stage 2: Paper versions of the surveys developed by the young people in the Young SAGE group will be distributed within participants' own schools. Data collation will be through Google Forms.

Sampling

Convenience samples: All stages of the research plan are intended to involve the schools of the Young SAGE participants themselves. It will be made clear that all pupils can opt-out of responding to the surveys, as well as individual questions.

SECTION 4: PARTICIPANTS

4.1 How many participants is it hoped to include in the research?: 800 approx

4.2 What criteria will be used in deciding on the inclusion and exclusion of participants in the study?

Pupils from the 4 schools which the Young SAGE participants attend will be invited to participate: S1 or S2 pupils (depending on preference of contact teachers on year group to attend) - approx 200 pupils per school to be involved.

4.3 How will the sample be recruited?

Recruitment will be through the Young SAGE participants in communication with teaching staff at their schools.

4.4 Will participants receive any financial or other material benefits because of participation? NO

4.5 Are any participants likely to experience difficulties in participating fully in the study? (e.g. due to age, knowledge of English language, physical ability, additional support needs etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported to participate.

Survey participants may experience difficulties with the survey due to language ability and potential additional support needs. It is anticipated that, as this survey is encouraged through schools, that these individuals should have the support to participate as they would with any other part of their education.

SECTION 5: POTENTIAL RISKS TO PARTICIPANTS/RESEARCHER

5.1 Could the research induce any psychological stress or discomfort in the particpants? YES

If YES, state the nature of the risk and what measures will be taken to deal with such problems.

Although we have indicated yes, we anticipate this is extremely unlikely for the survey.

5.2 Does the research require any physically invasive or potentially physically harmful procedures NO

5.3 Does the research involve the investigation of any illegal behaviours? NO

5.4 Is it possible that this research will lead to the disclosure of information about child abuse or neglect? YES

If YES, indicate the likelihood of such disclosure and your proposed response to this. If there is a real risk of such disclosure triggering an obligation to make a report to Police, Social Work or other authorities, a warning to this effect must be included in the Information and Consent documents.

Although we have indicated yes, we believe the chance of disclosures is extremely unlikely due to the nature of the subject matter in the survey, but it is always a possibility in any research with young people. If any items of concern are revealed, we will share these with the appropriate school staff.

5.5 Is there any purpose to which the research findings could be put that could adversely affect participants? YES

If YES, describe the potential risk for participants of this use of the data. Outline any steps that will be taken to protect participants.

Another extremely unlikely possibility. Survey responses will be anonymous, so there is minimal chance, and the subject matter makes any adverse effects incredibly unlikely.

5.6 Could this research adversely affect participants in any other way? YES

If YES, give details and outline procedures to be put in place to deal with such problems.

Another extremely unlikely possibility. In our view, we cannot envisage any issues, but we don't know the precise circumstances of all participants.

5.7 Could this research adversely affect members of particular groups of people? NO

5.8 Is this research expected to benefit the participants, directly or indirectly? YES

If YES, give details.

What is learnt from the project could/should lead to improved science experiences in the future, which may have an impact on the participants as well. For the Young SAGE group participants, the experience of running a research project and working with the University has potential positive benefits for their post-school plans and applications.

5.9 Will the true purpose of the research be concealed from the participants? NO

5.10 At any stage in this research could researchers' safety be compromised or could the research induce emotional distress in the researchers? YES

If YES, to either or both, give details and outline procedures to be out in place to deal with potential problems.

This is incredibly unlikely but cannot be totally discounted. Any serious matters will be reported to the schools of the Young SAGE participants, and I will discuss any longer-term issues with my

supervisors as required.

SECTION 6: PARTICIPANT INFORMATION AND CONSENT

6.1 Will written consent be obtained from participants? YES

Attachments: (NB you can upload multiple files at the same time)

1 file: (click to download)
docx.jpg Example pre-event survey for S1-S2-20171105.docx

Administrative consent may be deemed sufficient:

a. for studies where the data collection involves aggregated (not individual) statistical information and where the collection of data presents:

   i. no invasion of privacy;
   ii. no potential social or emotional risks:

b. for studies which focus on the development and evaluation of curriculum materials, resources, guidelines, test items, or programme evaluations rather than the study, observation, and evaluation of individuals.

6.2 Will administrative consent (eg. from a headteacher) be obtained in lieu of participants' consent? YES

If YES, explain why individual consent is not considered necessary.

Teachers at the schools of the Young SAGE participants have already been informed of the overall project as part of stage 1, and their consent for involving their pupils has been secured. An email inviting teachers to select the year group to attend the event (and hence to be involved in the remaining stages of the research plan) has just been sent.

For the S1 or S2 pupils, at the start of the survey it is made clear what the purpose of the survey is, and it will also be clear that pupils do not need to participate if they do not wish to.

6.3 Might any potential participants find it difficult to provide/withhold ongoing informed consent? (e.g. due to age, knowledge of English language, additional support needs, student/professional/dependent relationship with the researcher etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported during the ongoing consent process. If NO, give reasons.

For the survey, as previously stated, it is expected that those with English language and additional support needs will have the support required to engage with the surveys as appropriate, since the expectation is that these will be completed within school time.

However, being completed within school time can also make it unclear that participation is voluntary. To assist with this issue, a written statement is made at the start of the surveys to reinforce the message that pupils can choose not to respond.

SECTION 7: RESEARCH INVOLVING CHILDREN/VULNERABLE ADULTS

Complete this section only if your research involves minors, (ie individuals who are less than 18 years) or vulnerable adults.

7.1 All researchers who plan to work directly with children and vulnerable adults should obtain application forms from the Protecting Vulnerable Groups Scheme (PVG Scheme) See http://www.disclosurescotland.co.uk/apply/

Have you obtained the necessary, up to date Disclosure Scotland Clearance? YES

7.2 In the case of minors participating in the research on an individual basis, will the consent or assent of parents be obtained? NO

If YES, explain how this consent or assent will be obtained. If NO, give reasons.

Instead of parents, teachers from the schools will be asked for consent to ask their pupils to participate in the different project stages.

7.3 Will the consent or assent (at least verbal) of minors participating in the research on an individual basis be obtained? YES

If YES, what arrangements will be made? If NO, give reasons.

For the survey, a statement at the start will reinforce the message that participation is voluntary and pupils can opt-in/opt-out as they wish.

SECTION 8: CONFIDENTIALITY AND HANDLING OF DATA

8.1 Will the research require the collection of personal information frome.g. universities, schools, employers, or other agencies about individuals without their direct consent? NO

8.2 Will any part of the research involving participants be audio/film/video taped or recorded using any other electronic medium? NO

8.3 Who will have access to the raw data?

The Young SAGE group (including myself), as well as my supervisors.

8.4 How will the confidentiality of data, including the identity of participants, be ensured?

Raw data will not be shared beyond the people indicated in 8.3. No names will be requested for the surveys.

8.5 Specify where the datafiles/audio/video tapes, etc. will be retained after the study, how long they will be retained and how they will eventually be disposed of.

Once the award of the PhD has been made, the electronic and physical data will be disposed of. Any data on physical drives will be re-formatted to remove the data completely.

During the project, golden copies of the survey and audio data will be stored on my student data-storage area (and therefore automatically backed-up). For working with these data in the Young SAGE group, there will be some temporary storage on individual machines/laptops, but these data will be deleted as soon as it is practical. No data will remain on a machine/laptop after a Young SAGE group gathering - there will only be the central golden copy on my student data storage area. (Even if an individual machine is hacked at a later date and the hacker can recombine the deleted data fragments that could remain on a machine, none of the data can be attributed to an individual, so confidentiality will not be compromised.)

8.6 How do you intend for the results of the research to be used?

For this particular research plan, the outcomes of the survey will be used by the Young SAGE group to plan the event within stage 3.

On a wider scale, the outcomes of this project will be shared with providers of science experiences to improve what is developed for young people. Initially, this will be mainly colleagues in the University, but there could/should be possibilities of sharing the outcomes of this project more widely.

The research data will also contribute to my PhD project - especially the responses of the Young SAGE participants towards the data they gather.

8.7 Will feedback of findings be given to participants? YES

If YES, how and when will this feedback be provided?

At the end of the research plan, findings will be shared with schools for onward sharing with their pupils, and potentially presentations during assemblies. The precise process is still under discussion.

8.8 Does your research concern groups which may be construed as terrorist or extremist? NO

8.9 Will your research involve accessing material that could be viewed as promoting terrorism or extremism? NO

SECTION 9: CONFLICT OF INTEREST

The University has a draft 'Policy on the Conflict of Interest' (copies available from the Research Support Office). Regarding research the draft states that a conflict of interest would arise in cases where an employee of the University might be

> **"compromising research objectivity or independence in return for financial or non-financial benefit for him/herself or for a relative or friend."**

The draft policy also states that the responsibility for avoiding a conflict of interest, in the first instance, lies with the individual, but that potential conflicts of interest should always be disclosed, normally to the line manager or Head of Department. Failure to disclose a conflict of interest or to cease involvement until the conflict has been resolved may result in disciplinary action and in serious cases could result in dismissal.

9.1 Does your research involve a conflict of interest as outlined above? NO

SECTION 10: SIGNATURES

Students Signature: Stuart Dunbar Date: 06/11/17

Supervisor Signature: **Date:**

N.B. Have you attached copies of participant information sheet(s) and consent sheet(s) if appropriate? Have you checked through your application to ensure that you have answered all relevant questions?

Application Form ID=769

Appendix 12 – Ethics application D (initially submitted 27th January; final submission, 19th February 2018)

THE UNIVERSITY of EDINBURGH
Moray House School of Education

Research and Knowledge Exchange
Ethics Committee

Student Application Form V2

PROCEDURE FOR ETHICAL APPROVAL

This form must be completed electronically by all Postgraduate students (taught or research degree) prior to research commencing.

PhD/EdD Student

All Levels: Applications must be authorised by your supervisor and submitted to the Ethics Committee. The Ethics Committee will review your application and provide feedback and authorisation.

Research should not commence until the supervisor(s) and, where necessary, the Ethics Committee have approved the ethics application.

Level 1: Your research project is completely desk-based (i.e. does not involve participants) and does not use information about living, identifiable individuals ('data subjects').

Level 2: Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

Level 3: Applies to novel procedures, research without consent, sensitive personal data, or the use of atypical participant groups. Also projects in which ethical issues might require more detailed consideration but are unlikely to prove problematic.

Level 4: Applies to research which is potentially problematic in that it may incorporate an inherent physical or emotional risk to researchers or participants; involve covert surveillance or covert data collection; or includes research studies in the NHS involving humans, their tissue and/or data.

SECTION 1: STUDENT & PROJECT DETAILS

1.1 Student Name: Stuart Dunbar

1.2 Programme: PhD

1.3 Supervisor(s): John Davis

1.4 Institute: ECS

1.5 Title of Research Project: Exploring public engagement with science involving young people: a case study approach

1.6 Proposed research start date: 20/2/18

1.7 Project Duration: May 2018

SECTION 2: ETHICS CATEGORY & GUIDANCE

2.1 Please tick the box which best describes your proposed research study:

◉ **Level 2:** Applies to non-intervention research where you have the consent of the participants and data subjects. This may include, for example, analysis of archived data, classroom observation, or questionnaires on topics that are not generally considered 'sensitive'. This research can involve children or young people, if the likelihood of risk to them is minimal.

2.2 Ethical giudelines followed (tick all that apply)

☑ British Educational Research Association (BERA)

2.3 Does the project require the approval of any other institution and/or ethics committee? NO

SECTION 3: DESCRIPTION OF THE RESEARCH

Overview

Within the field of Public Engagement with Science, research regarding views of different groups on engagement activities is a recent development, with children and young people still generally absent. The current project aims to address this gap through establishing and collaborating with Young SAGE: a young person advisory group for public engagement in the College of Science and Engineering at the University of Edinburgh. The Young SAGE project is part of my wider research into the preferences of young people in science experiences, as well as into the benefits and tensions of young person advisory groups within a Higher Education Institution setting. The full set of my research questions can be found in my original ethics application in June 2016.

Clarification

The present application applies to the informal evaluation (stage 3b) and the post-event survey (stage 4) within the collaborative phase of the Young SAGE project which involves a group of local young people (16-18 years old), who have participated since late 2016. I already received ethical clearance for the overall project in June 2016, the initial survey (stage 1 of the plan below) and for the pre-event survey stage in Nov 2017 (stage 2). Timelines have been updated since the last ethics application (approval reference number: 1207).

Stage 3a - the event - is outside the scope of the present ethics application. I am supporting the development of the event following the standard processes I employ for other collaborative University events that I coordinate (e.g. Science on a Summer's Evening, Doors Open Day at the King's Buildings). Contributions of interactive science experiences are being sought from staff/students of the University, as well as representatives of other prominent institutions. I have already received confirmation from the University Insurance department that the University contributors to the event are covered by relevant policies, and we are ensuring that any non-University of Edinburgh contributors have cover in place. Signed Risk Assessments from all activity contributors are being sought. Young SAGE participants will secure visiting S1/S2 groups from their own schools following discussions with their teachers.

Aims/Objectives of Study

Initial discussions with the Young SAGE participants have led to an outline research plan (see below). Aspects of the present ethics application have been worked on in collaboration with the Young SAGE project participants.

Research question for Young SAGE – developed in the initial phase of our group gatherings

“Can interactive science experiences change young students’ interest in science?”

Outline research plan

1. A survey of 16-18 year olds based on exploring the science experiences they would have liked at primary / early secondary school level. Completed late-Sept.

2. A survey of 11-14 year olds attending stage 3 (below) to gauge current interest in science and their science experiences to date. Expected completion: late-Feb 2018.

3a. An event for 11-14 year olds informed by the survey for 16-18 year olds. Interactive science experiences to be provided by University staff/students and other local relevant institutions. Target date: 1st March 2018.

3b. Informal evaluation data will be secured in two ways: i) A suggestion box with cards will be present at the event to allow event attendees to provide comments; and ii) reflections on the event will be made by the Young SAGE team in discussion with me immediately after the event. I already have ethics clearance for these types of discussions with the Young SAGE participants. Target date: 1st March 2018.

4. A post-event survey of 11-14 year olds involving similar questions to stage 2. The focus of the present ethics application. Target date: April 2018.

After experience of stage 1, paper-based surveys will be used to gather data from respondents. Collation of data through Google Forms. As of 26th Jan, the Young SAGE group does not intend to carry out a formal group interview as indicated in earlier ethics applications. Within the discussions on the 18th Feb, the informal evaluation approach (stage 3b) has been developed as a substitute.

Sampling

Convenience samples: All stages of the research plan are intended to involve the schools of the Young SAGE participants themselves. It will be made clear that all pupils can opt-out of responding to the surveys, as well as individual questions; an explicit consent question is included in the survey. For the suggestion box, attendees to the event can share comments through cards if they wish - there will be no requirement to write comments.

Contribution to my PhD research

The contribution of this study to my research is two-fold. Firstly, how the Young SAGE participants interpret the data received through the surveys - as well as their observations during the event - will contribute to my research

questions that are concerned with young people's preferences within science experiences. Secondly, the process of collaborating with the Young SAGE participants will provide data related to my research questions around power and agency in young person advisory groups linked to Higher Education Institutions.

SECTION 4: PARTICIPANTS

4.1 How many participants is it hoped to include in the research?: 160-200

4.2 What criteria will be used in deciding on the inclusion and exclusion of participants in the study?

S1/S2 pupils from the 4 schools which the Young SAGE participants attend will be invited to participate. The classes will be down to a discussion between the Young SAGE participants and their teachers, with the school policies on taking pupils out of school being followed. Ideally attending classes will represent the range of ability in science, but practicalities of timings may restrict potential participation. Also, some pupils may not wish to attend!

4.3 How will the sample be recruited?

By the Young SAGE participants in direct discussion with their teachers.

4.4 Will participants receive any financial or other material benefits because of participation? NO

4.5 Are any participants likely to experience difficulties in participating fully in the study? (e.g. due to age, knowledge of English language, physical ability, additional support needs etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported to participate.

Survey participants may experience difficulties with the surveys due to language ability and potential additional support needs. It is anticipated that, as these surveys will be available through schools, that these individuals should have the support to participate as they would with any other part of their education.

(For info: Physical abilities and additional support needs may impair the accessibility of some of the science experiences in the March event, but again we anticipate that support will be available in line with the individuals' general education.)

SECTION 5: POTENTIAL RISKS TO PARTICIPANTS/RESEARCHER

5.1 Could the research induce any psychological stress or discomfort in the particpants? YES

If YES, state the nature of the risk and what measures will be taken to deal with such problems.

For the survey and suggestion box, the chance of psychological harm seems very unlikely.

(For info: within the event, an individual may have a phobia of an element in an experience in the March event. We do not intend for all event attendees to have every available experience, so those with phobias could opt-out of specific experiences.)

5.2 Does the research require any physically invasive or potentially physically harmful procedures YES

If YES, give details and outline procedures to be put in place to deal with potential problems.

Although we believe this is highly unlikely. The surveys and suggestion box should not cause any issues.

(For info: the science experiences in the March event will be risk-assessed, so there is an extremely minimal chance of physically harmful procedures.)

5.3 Does the research involve the investigation of any illegal behaviours? NO

5.4 Is it possible that this research will lead to the disclosure of information about child abuse or neglect? YES

If YES, indicate the likelihood of such disclosure and your proposed response to this. If there is a real risk of such disclosure triggering an obligation to make a report to Police, Social Work or other authorities, a warning to this effect must be included in the Information and Consent documents.

Although we have indicated yes, we believe the chance of disclosures is extremely unlikely due to the nature of the subject matter, but it is always a possibility in any research with young people.

(For info: although the Young SAGE participants are leading the development of the event, I will be available to provide advice on disclosures if necessary. My past experience as a primary school teacher, and ongoing experience in working in secondary schools with the SCI-FUN Roadshow, mean I am sensitive to the potential of disclosures. Any issues will be shared with the school staff accompanying the event attendees.)

5.5 Is there any purpose to which the research findings could be put that could adversely affect participants? YES

If YES, describe the potential risk for participants of this use of the data. Outline any steps that will be taken to protect participants.

Another extremely unlikely possibility. Survey and suggestion box responses should be anonymous, so there is minimal chance, and the subject matter makes any adverse effects incredibly unlikely.

5.6 Could this research adversely affect participants in any other way? YES

If YES, give details and outline procedures to be put in place to deal with such problems.

Another extremely unlikely possibility for the surveys and suggestion box. In our view, we cannot envisage any issues, but we don't know the precise circumstances of all participants / event attendees.

(For info: some of the science experiences in the March event could present hazards, but risk assessments will minimise these and experiences will be accompanied by a 'presenter'. Event attendees can also opt-in/out of different experiences.)

5.7 Could this research adversely affect members of particular groups of people? YES

If YES, describe these possible adverse effects and the protection to be put in place against them.

Extremely unlikely, due to the nature of the subject matter.

(For info: religious beliefs could oppose some of the material within the March event science experiences. Event attendees can choose not to engage with such experiences.)

5.8 Is this research expected to benefit the participants, directly or indirectly? YES

If YES, give details.

The science experiences will hopefully be positive and fun, but that's part of our study! Depending on the nature of the activities, the experiences may also assist with the subject choice process that the event attendees will shortly be going through. What is learnt from the project could/should lead to improved science experiences in the future, and the Young SAGE group have already started to consider ways to share our learning from the project.

For the Young SAGE participants, the experience of running a research project and working with the University has potential positive benefits for their post-school plans and applications.

5.9 Will the true purpose of the research be concealed from the participants? NO

5.10 At any stage in this research could researchers' safety be compromised or could the research induce emotional distress in the researchers? YES

If YES, to either or both, give details and outline procedures to be out in place to deal with potential problems.

This is incredibly unlikely but cannot be totally discounted. For the survey, participants may have difficulties in gaining agreements with securing classes to visit the event, or permission in distributing the survey.

(For info: within the March event, some comments may take the research team – myself and the rest of the Young SAGE participants – by surprise (such as disclosures of sensitive matters). I will be present in the room during the event. Any serious matters will be reported to teaching staff who are present, and I will discuss any longer-term issues with my supervisors as required.)

SECTION 6: PARTICIPANT INFORMATION AND CONSENT

6.1 Will written consent be obtained from participants? YES

Attachments: (NB you can upload multiple files at the same time)

2 files: (click to download)

docx.jpg S1 and S2 Post-STEM Fair Survey - schools omitted.docx

docx.jpg Parent information sheet-20180218.docx

Administrative consent may be deemed sufficient:

a. for studies where the data collection involves aggregated (not individual) statistical information and where the collection of data presents:

   i. no invasion of privacy;
   ii. no potential social or emotional risks:

b. for studies which focus on the development and evaluation of curriculum materials, resources, guidelines, test items, or programme evaluations rather than the study, observation, and evaluation of individuals.

6.2 Will administrative consent (eg. from a headteacher) be obtained in lieu of participants' consent? YES

If YES, explain why individual consent is not considered necessary.

Discussions between Young SAGE participants and teachers at the schools are ongoing. Consent for involving S1/S2 pupils has been secured and now specific classes are being identified. However, participants' consent is still required for the different stages of the project.

It is made clear at the start of the survey what the purpose of the survey is, and it is made clear that pupils do not need to participate if they do not wish to.

(For info: for the March event, schools will require parental consent to bring the pupils to the venue or notify parents/carers following their usual policies. If pupils wish to opt-out of the different science experiences, then they may do so.)

6.3 Might any potential participants find it difficult to provide/withhold ongoing informed consent? (e.g. due to age, knowledge of English language, additional support needs, student/professional/dependent relationship with the researcher etc). YES

If YES, please outline the nature of this issue, and explain how participants will be supported during the ongoing consent process. If NO, give reasons.

For the survey, as previously stated, it is expected that those with English language and additional support needs will have the support required to engage with the surveys as appropriate, since the expectation is that these will be completed within school time.

However, being completed within school time can also make it unclear that participation is voluntary. To assist with this issue, a written statement is made at the start of the survey to reinforce the message that pupils can choose not to respond.

The suggestion box during the event will be available for attendees to voluntarily participate.

(For info: during the March event, pupils can choose not to engage with the activities.)

SECTION 7: RESEARCH INVOLVING CHILDREN/VULNERABLE ADULTS

Complete this section only if your research involves minors, (ie individuals who are less than 18 years) or vulnerable adults.

7.1 All researchers who plan to work directly with children and vulnerable adults should obtain application forms from the Protecting Vulnerable Groups Scheme (PVG Scheme) See http://www.disclosurescotland.co.uk/apply/

Have you obtained the necessary, up to date Disclosure Scotland Clearance? YES

7.2 In the case of minors participating in the research on an individual basis, will the consent or assent of parents be obtained? YES

If YES, explain how this consent or assent will be obtained. If NO, give reasons.

Teachers from the schools will be asked for consent to ask their pupils to participate in the different project stages. Through an information sheet, parents will be informed about the event and post-event survey.

7.3 Will the consent or assent (at least verbal) of minors participating in the research on an individual basis be obtained? YES

If YES, what arrangements will be made? If NO, give reasons.

For the survey, a statement at the start will reinforce the message that participation is voluntary and pupils can opt-in/opt-out as they wish.

For the suggestion box, cards will be available for event attendees to complete if they wish.

(For info: for pupils that attend the event, they may choose to not engage with the activities at all.)

SECTION 8: CONFIDENTIALITY AND HANDLING OF DATA

8.1 Will the research require the collection of personal information frome.g. universities, schools, employers, or other agencies about individuals without their direct consent? NO

8.2 Will any part of the research involving participants be audio/film/video taped or recorded using any other electronic medium? NO

8.3 Who will have access to the raw data?

The Young SAGE group (including myself), as well as my supervisors.

8.4 How will the confidentiality of data, including the identity of participants, be ensured?

Raw data will not be shared beyond the people indicated in 8.3. No names will be requested for the surveys or suggestion box cards.

8.5 Specify where the datafiles/audio/video tapes, etc. will be retained after the study, how long they will be retained and how they will eventually be disposed of.

Once the award of the PhD has been made, the electronic and physical data will be disposed of. Any data on physical drives will be re-formatted to remove the data completely.

During the project, golden copies of the survey and audio data will be stored on my student data-storage area (and therefore automatically backed-up). For working with these data in the Young SAGE group, there will some temporary storage on individual machines/laptops, but these data will be deleted as soon as it is practical. No data will remain on a Young SAGE machine/laptop after a Young SAGE group gathering - there will only be the central golden copy on my University storage area. (Even if an individual machine is hacked at a later date and the hacker can recombine the deleted data fragments that could remain on a machine, none of the data can be attributed to an individual, so confidentiality will not be compromised.)

For the surveys, I am keeping the hard copies, which do not have personal details on them. They will be disposed of at the end of the project. The data is being put into Google Forms and then downloaded to an Excel spreadsheet.

8.6 How do you intend for the results of the research to be used?

The outcomes of this project will be shared with providers of science experiences to improve what is developed for young people. Initially, this will be mainly colleagues in the University, but there could/should be possibilities of sharing the outcomes of this project more widely. Young SAGE participants are already considering ideas for how this stage could be achieved.

8.7 Will feedback of findings be given to participants? YES

If YES, how and when will this feedback be provided?

At the end of the research plan, findings will be shared with schools for onward sharing with their pupils, and potentially presentations during assemblies. The precise process is still under discussion.

8.8 Does your research concern groups which may be construed as terrorist or extremist? NO

8.9 Will your research involve accessing material that could be viewed as promoting terrorism or extremism? NO

SECTION 9: CONFLICT OF INTEREST

The University has a draft 'Policy on the Conflict of Interest' (copies available from the Research Support Office). Regarding research the draft states that a conflict of interest would arise in cases where an employee of the University might be

> **"compromising research objectivity or independence in return for financial or non-financial benefit for him/herself or for a relative or friend."**

The draft policy also states that the responsibility for avoiding a conflict of interest, in the first instance, lies with the individual, but that potential conflicts of interest should always be disclosed, normally to the line manager or Head of Department. Failure to disclose a conflict of interest or to cease involvement until the conflict has been resolved may result in disciplinary action and in serious cases could result in dismissal.

9.1 Does your research involve a conflict of interest as outlined above? NO

SECTION 10: SIGNATURES

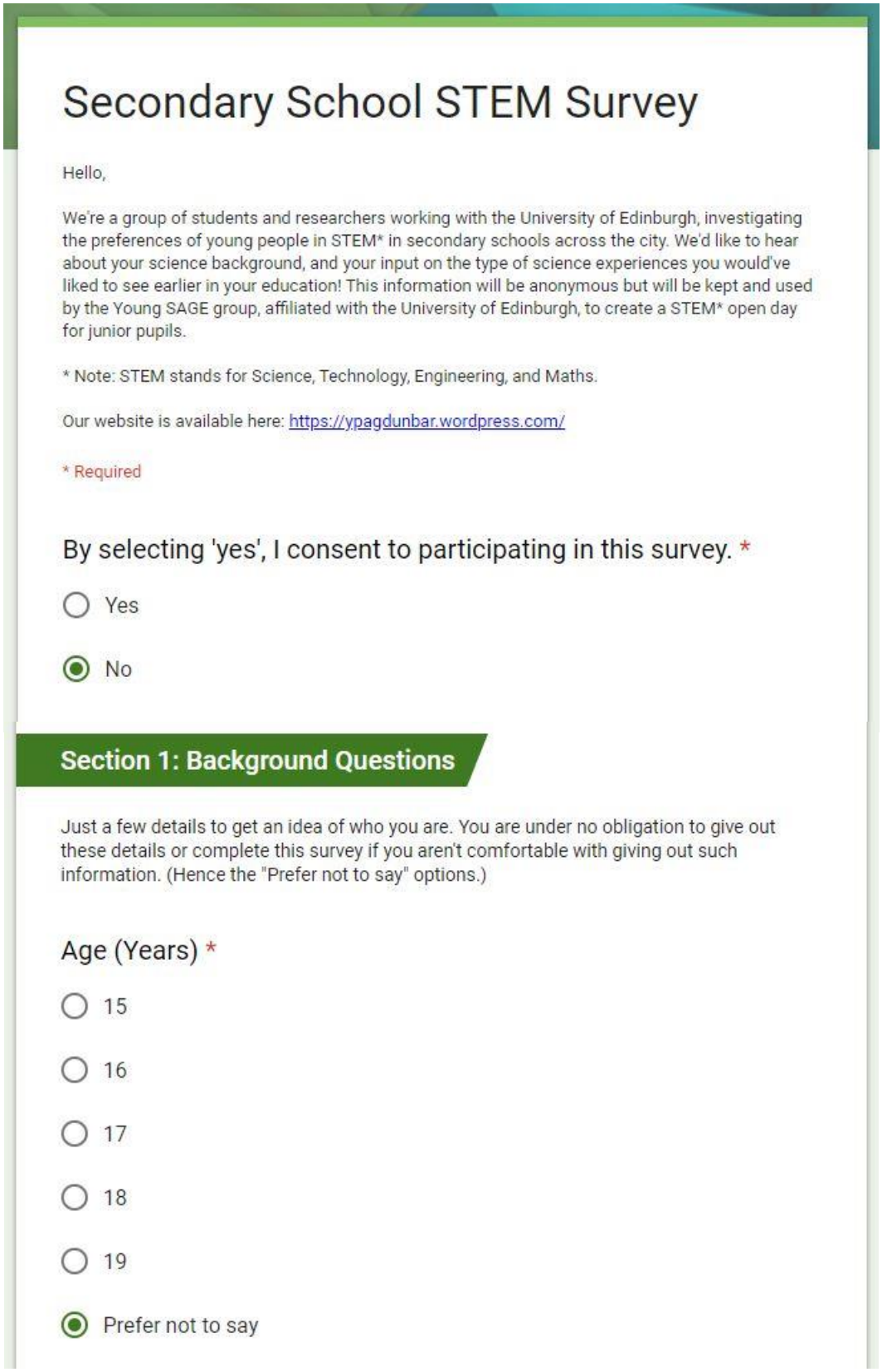
Students Signature: Stuart Dunbar Date: 19/2/18

Supervisor Signature: **Date:**

N.B. Have you attached copies of participant information sheet(s) and consent sheet(s) if appropriate? Have you checked through your application to ensure that you have answered all relevant questions?

Application Form ID=786

Appendix 13 – Young SAGE survey for senior pupils



Secondary School STEM Survey

Hello,

We're a group of students and researchers working with the University of Edinburgh, investigating the preferences of young people in STEM* in secondary schools across the city. We'd like to hear about your science background, and your input on the type of science experiences you would've liked to see earlier in your education! This information will be anonymous but will be kept and used by the Young SAGE group, affiliated with the University of Edinburgh, to create a STEM* open day for junior pupils.

* Note: STEM stands for Science, Technology, Engineering, and Maths.

Our website is available here: https://ypagdunbar.wordpress.com/

* Required

By selecting 'yes', I consent to participating in this survey. *

- ○ Yes
- ◉ No

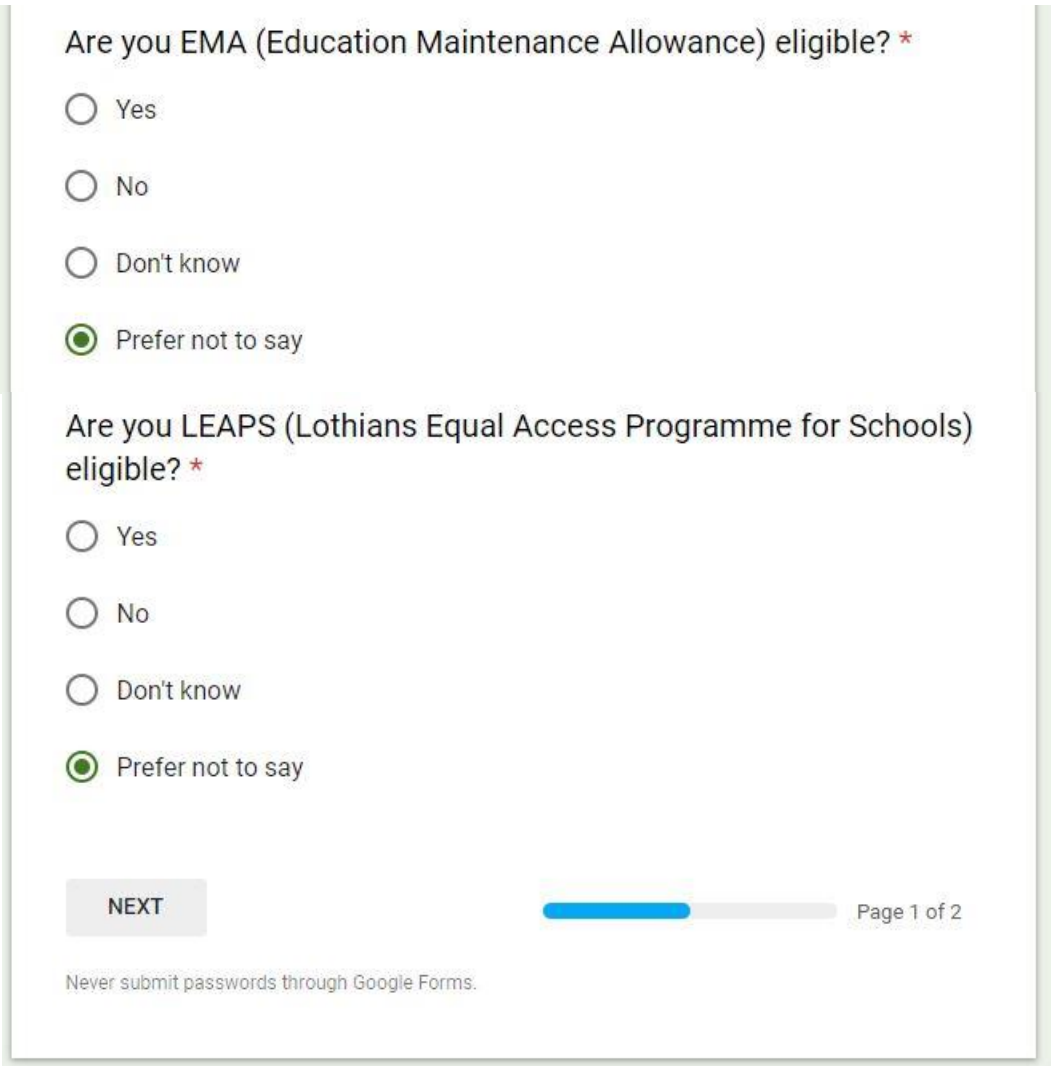
Section 1: Background Questions

Just a few details to get an idea of who you are. You are under no obligation to give out these details or complete this survey if you aren't comfortable with giving out such information. (Hence the "Prefer not to say" options.)

Age (Years) *

- ○ 15
- ○ 16
- ○ 17
- ○ 18
- ○ 19
- ◉ Prefer not to say

[Thesis note: School question redacted]



Secondary School STEM Survey

* Required

Section 2: STEM Questions

As a part of our group's mission, we're looking to further understand the effect of STEM* education and experiences on secondary school students, and we believe this sort of survey will help to further this objective. As before, you are under no obligation to answer every question or complete this survey, but it would be greatly appreciated.

All questions are required in this section as blank answers doesn't give us much insight into your experiences of STEM* subjects. If you really do not have anything to say then please specify so in your answers (e.g. "I have nothing to say.")

* Note: STEM stands for Science, Technology, Engineering, and Maths.

1. What type of STEM experiences / experiments have you enjoyed? For example, meeting with university professor(s), attending science festivals, work experience, etc. *

Your answer

2. What subjects are you studying, and in which course? For example, IB, Nat 5, Higher, GCSE. Please separate items with a comma (e.g. Higher Maths, Nat 5 English). Non-STEM subjects are accepted as answers. *

Your answer

3. Which of these subjects do you enjoy? Please separate items with a comma as above (e.g. Higher Maths, Nat 5 English). *

Your answer

4. a) Have you faced any discouragement or discrimination when considering studying STEM subjects? *

- ○ Yes
- ○ No
- ○ Unsure

4. b) If you said "yes" or "unsure" in the last question, please elaborate on your experiences.

Your answer

5. What STEM experiences would you liked to have seen in primary and early secondary school? *

Your answer

BACK SUBMIT Page 2 of 2

Never submit passwords through Google Forms.

Appendix 14 – Example gathering schedule: 13th gathering – 14th January 2018

Check research diary 010 for setup. At time of writing, five participants are available for the gathering on the 14th Jan.

Matters to attend to ahead of gathering:

1. Setup Doodle poll and seek responses – did Doodle poll to cover several dates in Jan (school hols and weekends) after 12th gathering…
2. Confirm date with participants – confirmed date after follow-ups 10/1
3. Select venue – [VENUE REDACTED]
4. Confirm location (and date) with participants – done 10/1
5. Obtain scratchcards for bus travel – still have sufficient
6. Order food – not necessary, going to BarBurrito again
7. Get WiFi codes for all participants – done 11/1
8. Get chocolates and bananas (or other fruit) for snacks, as well as paper plates / water.

Items to bring to gathering:

1. Staff card / Young SAGE tickets
2. Travel cards for buses / WiFi codes
3. Snacks / paper plates / water
4. Sharpies / post-its / large writing pad (A1) / sticky labels / clipboard / coloured paper
5. Notebook
6. This schedule! / Probes sheet
7. Mapping page - several (to write locations of participants)
8. Recorder and batteries
9. Consent forms
10. Blu-tack / masking tape
11. “Discussion Etiquette” cards / Science experiences discussion cards
12. Possible tasks and group comments from 2nd group gathering (small papers)
13. Discussion flipchart sheets from 3rd and 4th gatherings (large paper)
14. Methods pros/cons on coloured slips (5th gathering)
15. Ethics forms / survey advice sheet from Sarah A (Eric J workshop)
16. 4x example surveys (mine / JDs) in case... plus copies of 16-18yo survey
17. Print outs of event planning template

Schedule summary:

Before	Prepare room – have materials available.	11:30am
Task 0	Lunch in BarBurrito	12:30pm
Task 0.5	Agree on the priorities for today's gathering: the rest of the gathering could follow one of the following foundations (although we could do something completely different!)	1:15pm
Task A	Continue with the existing plan: check surveys, group interview approach, plans for events, and undertake more actions	
Task B	Amend existing plan: similar to Task A above, but altered within the group discussion	
Task C	Discuss new ideas and consider timeline and aims	
Task D	Stop the project today. Ask questions (based on exit interview) on what we could have done differently in Young SAGE	
Task A-5	Next gathering – when and what to do in interim?	3:15pm
Finish		3:30pm

Before		**60 mins**
11:30am	Set-up room – materials on separate table including possible tasks (2nd gathering)	
	Put Discussion Etiquette on walls/board. Suggested main question: "Can interactive science experiences change young students' interest in science?"	
	Have discussion sheets from 3rd and 4th gatherings, as well as methods pros/cons available	
Task 0	**Aim: catching-up in BarBurrito**	**45 mins**
12:30pm	Put recorder on	30 mins
	During lunch, may need to have a short group-interaction activity of some type…? (Could be simply: "What's the last movie you saw?")	
	Reminder that participants can ask me about anything to do with Young SAGE project / my role at University	
1pm	After: move to meeting room	15 mins
Task 0.5	**Aim: ownership**	**10 mins**
1:15pm	If necessary, ask participants to summarise where we are at.	5 mins
1:20pm	What do we want to do next? We could:	10 mins

	A. Continue with existing plan B. Amend existing plan C. Produce new ideas D. Stop the project today Be open during this discussion – ensure participants take the lead in making the choice!	
Task A-1	**Aim: continue existing plan**	**45 mins**
1:30pm	Consider what we need to do for event planning. Review planning sheet to date and continue. • Where? (One location? In schools?) • When? • Who invited to deliver activities and how invited? • How long would the sessions be? • How many sessions? • How many S1/S2 in each session? • Info sheet(s) for pupils/parents/carers? (inc as task 3c?) Who should do what to prepare the event?	15 mins
1:45pm	Group to split to work on ideas for different parts of the event plan template. Work with the areas they choose to focus on.	15 mins
2pm	Get groups to update each other – add progress to the central planning template. Discuss any concerns/tensions as required.	15 mins
Reset task 2:15pm	Either get participants moving: two physical locations – move to one or other depending on answer to ridiculous question. Then choose some to explain. See page 5 for questions. OR ask about interesting/weird YouTube videos (like in the 5th gathering!) OR ask participants to provide an option!	10 mins
Task A-2	**Aim: continue existing plan**	
2:25pm	Sub-group 1: check pre- and post-surveys • What's the purpose of the survey? • Confirm the questions that we should try to get answered. Are all of these questions useful? • How should the surveys be delivered? (Paper/online/who?)	15 mins
Task A-3	**Aim: continue existing plan**	

2:25pm	Sub-group 2: check group interviews – post-event progress. • How should these be set-up? • Who will be involved and how invited? • What questions will be prioritised?	15 mins
Summary of A-2/3 2:35pm	Review the progress as one group. Invite comments from the other group and resolve any tensions	10 mins
Task A-4	**Aim: continue existing plan**	**30 mins**
2:45pm	Most of ethics comments we can now respond to – questions we will ask and how people will be involved. Preference to resubmit? (Participants update? / I update and share before submission? / I update and submit, notifying everyone?) Before submitting ethics application, need to do information letter(s) for carers? / parents? / teachers? / pupils? Review draft of teacher letter from earlier gathering. How should the information letters for the others (parents/carers and pupils) be drafted? (Two groups again?)	30 mins
Task A-5	**Aim: continue existing plan**	**15 mins**
3:15pm	When should the next gathering be? What should we aim to do in the next gathering? What should we aim to do ahead of the next gathering?	15 mins
3:30pm	Finish	
Task B	**Aim: amend existing plan**	
	First: discuss what will be retained, what will be changed and how? Then: work on sub-sections in Task A as appropriate.	
Task C	**Aim: produce new ideas**	
	1. Open up discussion amongst participants in what could be done – start with their ideas and throw in my own if there is the opportunity. 2. Explore target end-date that's mutually agreeable. 3. Explore what outcome would be beneficial and to whom are we aiming our work?	

	4. Discuss what we need to do and by when. 5. Consider ethics requirements. 6. If can start working on idea today, then do so, consider splitting into sub-groups and recombining for wider views. Possible ideas I have so far: i. Use own ideas to produce advisory material aimed at Uni people (any engagers?) for those looking to engage CYP. Could be paper-based, video, animation, audio, podcast. E.g "How to…" or "do's / don'ts" ii. Explore 16-18yo survey in more detail as a basis for producing advisory material (as stated above) iii. Observe an SFR event and evaluate it – potentially interview or survey attendees. (Needs ethics.) iv. Observe another science engagement event and evaluate it – potentially interview or survey attendees. E.g. EISF / NMS (Needs ethics.) v. Attend Academics Unplugged event or other public lecture and evaluate within the group from own experience. vi. Assess the SFR materials and provide advisory conclusions. SFR events: [LIST OF DATES AND VENUES REDACTED] Then go to **Task A-5**: discuss next gathering and what to do in the interim.	
Task D	**Aim: stop the project today**	
	Consider asking some of the questions from the exit interview to explore views about the project: i. If you had complete control of the Young SAGE project – from the beginning – how would you have done things? Can you explain these choices? ii. Do you have any comments on the website? (Changes?) iii. Do you have any comments on the application process? (Changes?) iv. Any comments on how the gatherings are arranged? (Would having a fixed day be better?)	

	v. For any adult putting a group like Young SAGE together, what do they need to do to make the project successful? (What improvements can be made? What did I do wrong?) vi. Have you benefitted from your involvement in Young SAGE? In what ways? vii. Has the Young SAGE project met your expectations? (How?) viii. Any comments on the communications inbetween each gathering? (Moodle / email / phone) ix. A future Young SAGE group: a) should this happen? b) comments on participants to include? (e.g. how to attract them?) c) what should the priorities of a new group be? d) would using the current group's ideas be a useful starting point? x. Anything else in the Young SAGE project you'd like to talk about?	

Reset task (if needed)

1. Responses by standing along an imaginary line

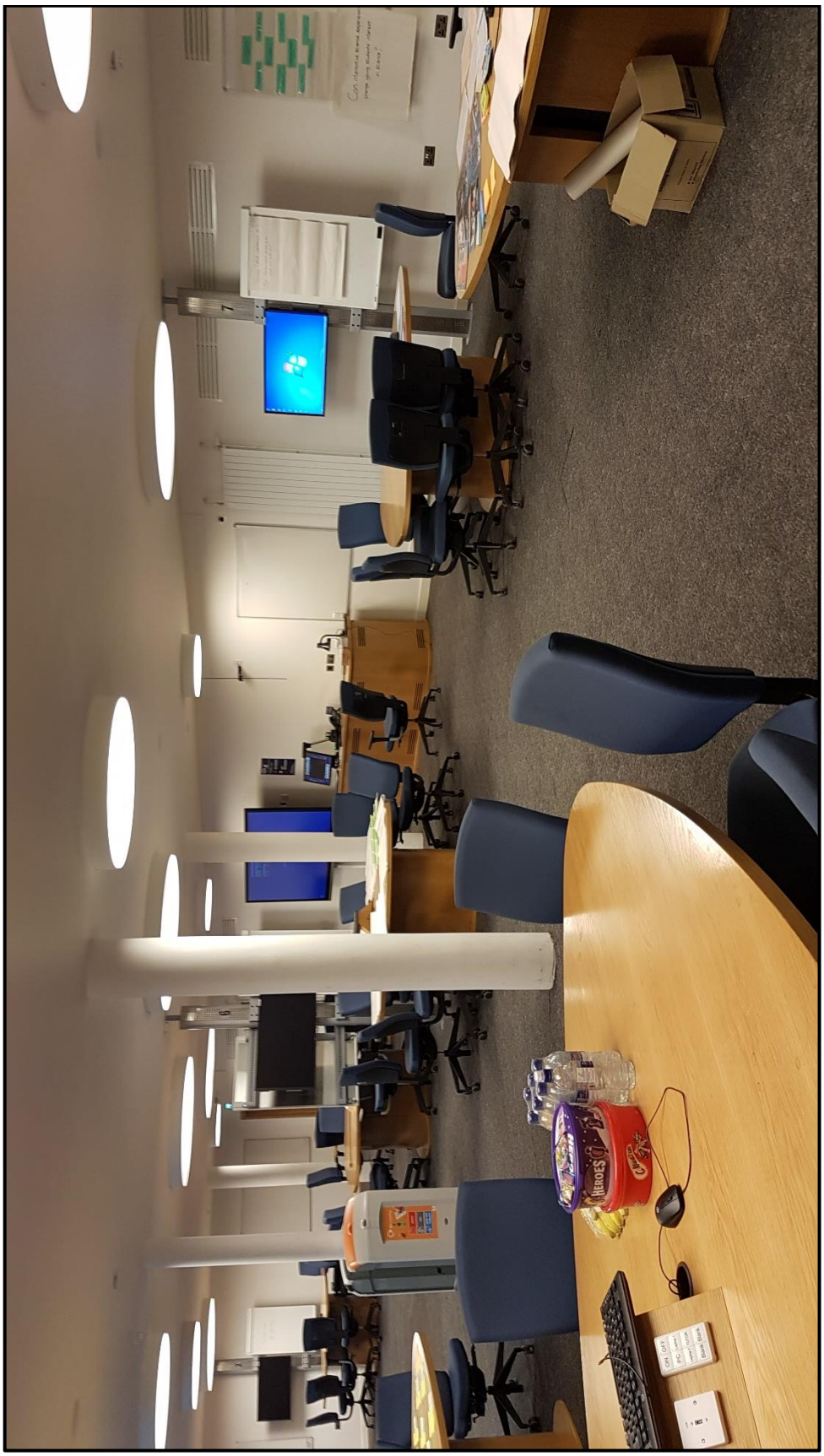
Q's

A. Which is the better invention: the computer or the smartphone?
B. What type of weather is best: warm and rainy, cold and dry?
C. Would you prefer to be attacked by one elephant-sized fox or 12 fox-sized elephants?

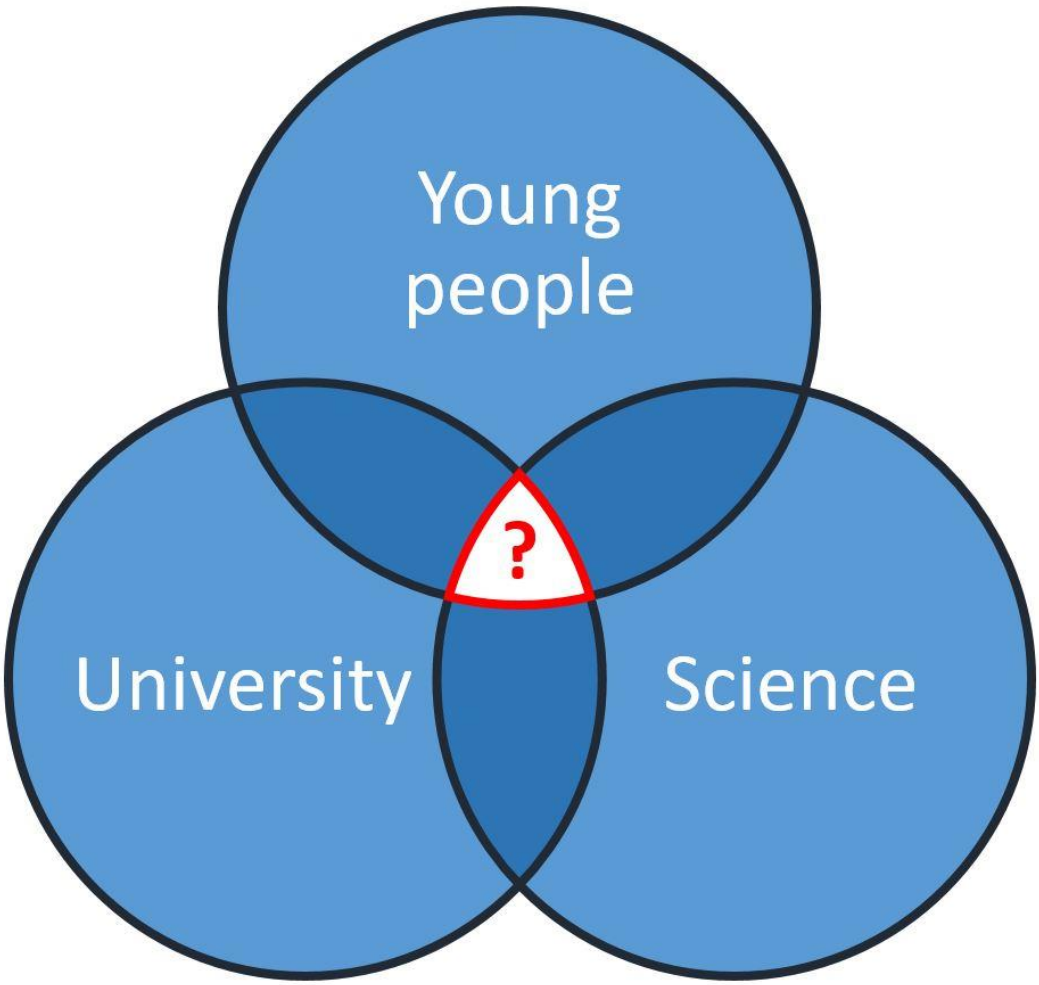
Appendix 15 – Example images of gathering venues

From 2nd Young SAGE gathering, 5th Feb 2017

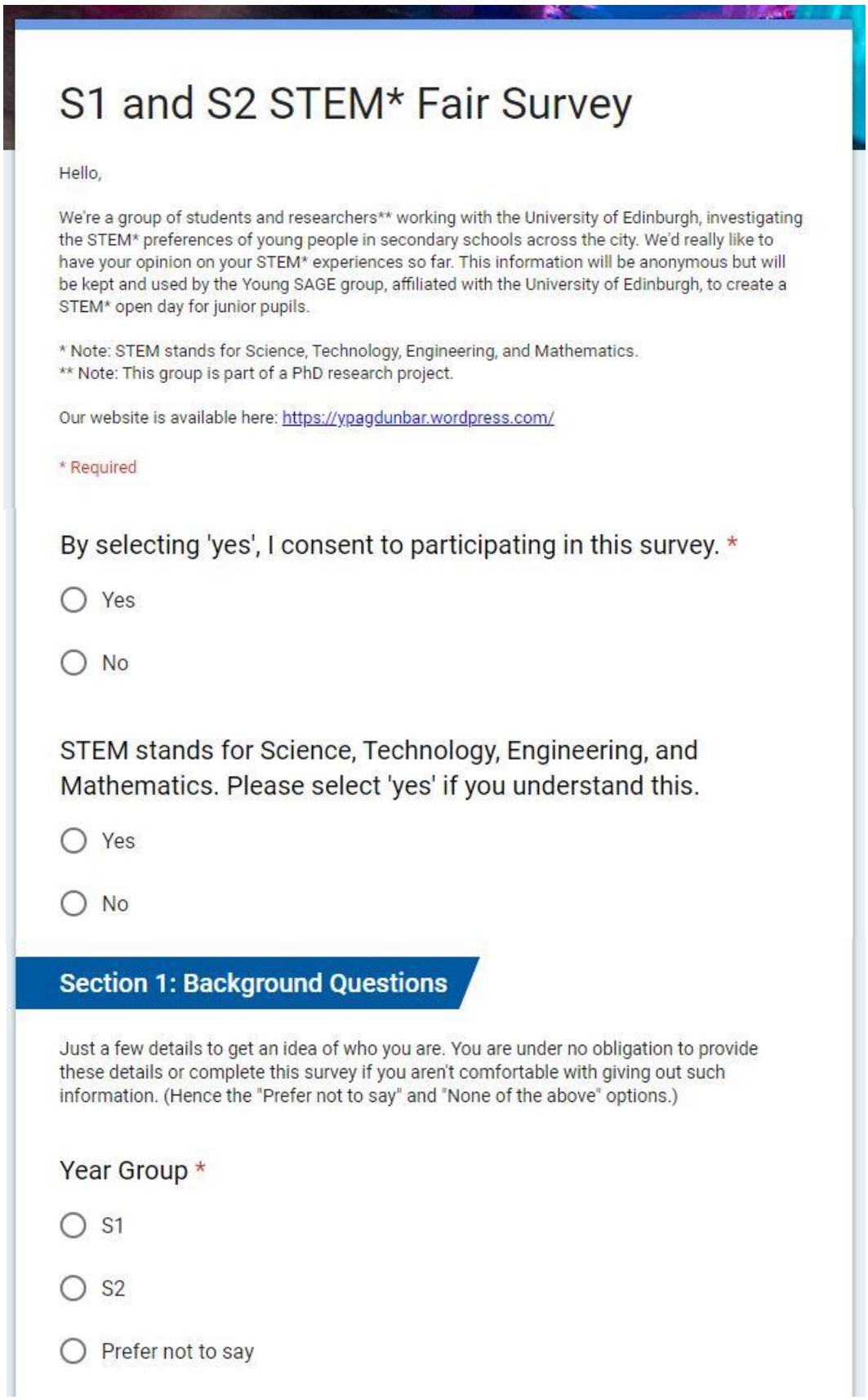
From 13th gathering, 14th January 2018



Appendix 16 – Young SAGE logo



Appendix 17 – Pre-event Young SAGE survey: online version



S1 and S2 STEM* Fair Survey

Hello,

We're a group of students and researchers** working with the University of Edinburgh, investigating the STEM* preferences of young people in secondary schools across the city. We'd really like to have your opinion on your STEM* experiences so far. This information will be anonymous but will be kept and used by the Young SAGE group, affiliated with the University of Edinburgh, to create a STEM* open day for junior pupils.

* Note: STEM stands for Science, Technology, Engineering, and Mathematics.
** Note: This group is part of a PhD research project.

Our website is available here: https://ypagdunbar.wordpress.com/

* Required

By selecting 'yes', I consent to participating in this survey. *

- ◯ Yes
- ◯ No

STEM stands for Science, Technology, Engineering, and Mathematics. Please select 'yes' if you understand this.

- ◯ Yes
- ◯ No

Section 1: Background Questions

Just a few details to get an idea of who you are. You are under no obligation to provide these details or complete this survey if you aren't comfortable with giving out such information. (Hence the "Prefer not to say" and "None of the above" options.)

Year Group *

- ◯ S1
- ◯ S2
- ◯ Prefer not to say

[Thesis note: School question redacted]

S1 and S2 STEM* Fair Survey

* Required

Section 2: STEM* Questions

As a part of our group's mission, we're looking to further understand the effect of STEM* education and experiences on junior secondary school students, and we believe this sort of survey will help to further this objective. As before, you are under no obligation to answer every question or complete this survey, but it would be greatly appreciated.

* Note: STEM stands for Science, Technology, Engineering, and Mathematics.

Which of the following subjects do you enjoy? *

- [ ] CDT (Craft and Design Technology)
- [ ] Computing Science/ICT
- [ ] Geography
- [ ] Mathematics
- [ ] Science (Biology)
- [ ] Science (Chemistry)
- [ ] Science (Physics)
- [ ] Science (All)
- [ ] None of the above

Which of these subjects are you considering studying later in school?

- [ ] CDT (Craft and Design Technology)
- [ ] Computing Science/ICT
- [ ] Geography
- [ ] Mathematics
- [ ] Science (Biology)
- [ ] Science (Chemistry)
- [ ] Science (Physics)
- [ ] Science (All)
- [ ] None of the above

Which subjects do you find the hardest? *

- [ ] CDT (Craft and Design Technology)
- [ ] Computing Science/ICT
- [ ] Geography
- [ ] Mathematics
- [ ] Science (Biology)
- [ ] Science (Chemistry)
- [ ] Science (Physics)
- [ ] Science (All)
- [ ] None of the above

I have been encouraged to take STEM* subjects. *

- ○ Strongly agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly disagree
- ○ I don't know

Please explain your answer to the previous statement.

Your answer

Would you be interested in attending an interactive STEM* event that aims to provide a fun and engaging experience? *

- ○ Yes
- ○ No
- ○ I don't know
- ○ Prefer not to say

BACK SUBMIT

Never submit passwords through Google Forms.

Appendix 18 – Pre-event Young SAGE survey: physical version

S1 and S2 STEM* Fair Survey

We're a group of students and researchers** working with the University of Edinburgh, investigating the STEM* preferences of young people in secondary schools across the city. We'd really like to have your opinion on your STEM* experiences so far. This information will be anonymous but will be kept and used by the Young SAGE group, affiliated with the University of Edinburgh, to create a STEM* open day for junior pupils.

* Note: STEM stands for Science, Technology, Engineering, and Mathematics.
** Note: This group is part of a PhD research project.

Our website is available here: https://ypagdunbar.wordpress.com/

By ticking 'yes', I consent to participating in this survey.

- ◯ Yes
- ◯ No

SECTION 1: Background Questions

Just a few details to get an idea of who you are. You are under no obligation to provide these details or complete this survey if you aren't comfortable with giving out such information (hence the "Prefer not to say" and "None of the above" options).

Year group:

- ◯ S1
- ◯ S2
- ◯ Prefer not to say

Gender:

- ◯ Male
- ◯ Female
- ◯ Other
- ◯ Prefer not to say

School:

- ◯ REDACTED
- ◯ REDACTED
- ◯ REDACTED
- ◯ REDACTED
- ◯ Prefer not to say

Are you eligible for free school meals?

- ◯ Yes
- ◯ No
- ◯ I don’t know
- ◯ Prefer not to say

SECTION 2: STEM* Questions

As a part of our group's mission, we're looking to further understand the effect of STEM* education and experiences on junior secondary school students, and we believe this sort of survey will help to further this objective. As before, you are under no obligation to answer every question or complete this survey, but it would be greatly appreciated.

* Note: STEM stands for Science, Technology, Engineering, and Mathematics.

Which of the following subjects do you enjoy?

- ○ CDT (Craft and Design
- ○ Computing Science/IT
- ○ Geography
- ○ Mathematics
- ○ Science (Biology)
- ○ Science (Chemistry)
- ○ Science (Physics)
- ○ Science (All)
- ○ None of the above

Which subjects do you find the hardest?

- ○ CDT (Craft and Design
- ○ Computing Science/IT
- ○ Geography
- ○ Mathematics
- ○ Science (Biology)
- ○ Science (Chemistry)
- ○ Science (Physics)
- ○ Science (All)
- ○ None of the above

I have been encouraged to take STEM subjects.

- ○ Strongly agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly disagree
- ○ I don’t know

Please explain you answer to the previous statement.

Would you be interested in attending an interactive STEM* event that aims to provide a fun and engaging experience?

- ○ Yes
- ○ No
- ○ I don’t know
- ○ Prefer not to say